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3DArtist

61

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ANIMATING THE SONY WAY
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Blender Cookie reveals its workflow for realistic dinosaur skin

REALISTIC SCI-FI CITIES
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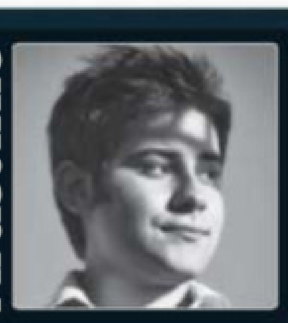
> FiberMesh is just one of ZBrush's many powerful options, so here we'll use it to make a truly photoreal and captivating image

Yasin Hasanian harnesses ZBrush, Maya MARI and Arnold to create this issue's amazing cover art **Page 50**

Master realistic hair & fur

page 50

Artist info



Yasin Hasanian

Personal portfolio site
superhero.cgsociety.org

Location Iran

Software used Maya, ZBrush, MARI, Shave and a Haircut, Arnold, Photoshop

We've got an awesome feature-packed edition of ***3D Artist*** *for you this issue. Starting on p24 we take a look at the history of CG software, learning where today's tools started out. On p40 we consider the future and the dawn of the Unreal Engine 4. Finally on p32 we fix our focus firmly on the present, going behind the scenes of the imaginative* Cloudy with a Chance of Meatballs 2.

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Whet your appetite for *Cloudy 2* on page 32

Welcome

to the magazine and 116 pages of amazing 3D

Hello and welcome to 3D Artist magazine! This issue we're taking a look at two ends of the CG spectrum. Yasin Hasanian reveals the process behind his remarkably realistic tiger cover on page 50, while Sony discusses its approach to some of the funniest cartoon animation going in *Cloudy With a Chance of Meatballs 2* on page 32. Also, make sure you check out the exclusive 30-day ChronoSculpt trial found on the disc this issue – it's exciting stuff indeed!

Chris Deputy Editor

Every issue you can count on...

1. **Exclusively commissioned art**
2. Behind-the-scenes guides to images and fantastic artwork
3. **A CD packed full of creative goodness**
4. Interviews with inspirational artists
5. **Tips for studying 3D or getting work in the industry**
6. The chance to see your art in the mag!

This issue's team of expert artists...

Yasin Hasanian

You may have noticed a rather striking tiger on the cover. On p50 Yasin reveals how he created this amazing beast

Brooks Patrick

Want to create realistic cities in a few short minutes? Turn to p60 for Brooks' tutorial on the brilliant CityEngine

Jonathan Williamson

Jonathan continues his Blender dinosaur series, this issue discussing the intricacies of texturing

Jahirul Amin

Maya maven Jahirul has created a steam train for **3D Artist** readers in this first of a three-part series

Chévon Leo

Carve fear into the features of your characters, with Chévon's ZBrush tutorial on p74

Cody Burke

Make sure you try out the exclusive 30-day ChronoSculpt trial and follow Cody's tutorial. Exciting stuff!

Anselm von Seherr-Thoss

Anselm reveals one of the simulation processes he used to bring *Star Trek: Into Darkness* to life

Rainer Duda

Following on from last issue's modelling tutorial, Rainer now shows how to rig his *Charger* model

George Smaragdis

OpenPipeline is a free program that could help streamline your projects. Find out how with George on p88

James Morris

Tech expert James puts not one, but three workstations under the microscope this issue, starting on p92

Craig A Clarke

Craig takes a good long look at ChronoSculpt and explores what NewTek's latest tool can do for your projects

Alan Marques

Our iClone authority Alan puts the latest Reallusion release through its paces over on p97

Sign up, share your art and chat to other artists at www.3dartistonline.com

3DArtist

Imagine Publishing Ltd
Richmond House, 33 Richmond Hill
Bournemouth, Dorset BH2 6EZ
☏ +44 (0) 1202 586200
Web: www.imagine-publishing.co.uk
www.3dartistonline.com
www.greatdigitalmags.com

Magazine team

Deputy Editor Chris McMahon
chris.mcmahon@imagine-publishing.co.uk
☏ 01202 586239
Editor in Chief Dan Hutchinson
Staff Writer Larissa Mori
Sub Editor Tim Williamson
Senior Designer Chris Christoforidis
Photographer James Sheppard
Senior Art Editor Duncan Crook
Head of Publishing Aaron Asadi
Head of Design Ross Andrews

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Contributors
Jahirul Amin, Cody Burke, Craig A Clark, Rainer Duda, Yasin Hasanian, Chévon Leo, Alan Marques, James Morris, Brooks Patrick, Adam Sacco, David Scarborough, Anselm von Seherr-Thoss, George Smaragdis, Poz Watson, Jonathan Williamson.

Advertising
Digital or printed media packs are available on request.
Advertising Director Matthew Balch ☏ 01202 586437
matthew.balch@imagine-publishing.co.uk
Head of Sales Hang Deretz ☏ 01202 586442
hang.deretz@imagine-publishing.co.uk
Advertising Manager Jennifer Farrell ☏ 01202 586430
jennifer.farrell@imagine-publishing.co.uk
Account Manager Ryan Ward ☏ 01202 586415
ryan.ward@imagine-publishing.co.uk

Cover disc
Junior Web Designer Steven Usher
3daxtrahelp@imagine-publishing.co.uk

International
3D Artist is available for licensing. Contact the International department to discuss partnership opportunities.
Head of International Licensing Cathy Blackman
☏ +44 (0) 1202 586401
licensing@imagine-publishing.co.uk

Subscriptions
Head of Subscriptions Gill Lambert
To order a subscription to **3D Artist:**
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Circulation
Head of Circulation Darren Pearce ☏ 01202 586200

Production
Production Director Jane Hawkins ☏ 01202 586200

Founders
Group Managing Director Damian Butt
Group Finance & Commercial Director Steven Boyd
Group Creative Director Mark Kendrick

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Contents

What's in the magazine and where

News reviews & features

8 The Gallery
A hand-picked selection of incredible artwork to inspire you

16 Community news
Keep up-to-date with the latest news from the world of 3D

20 Readers' gallery
The 3DArtistOnline.com community art showcased

22 Have your say
The best posts and stories from our Facebook and Twitter pages

24 The evolution of CG software
We go back in time with Maya, 3ds Max, Houdini and more

32 Animating the Sony way
Sony discusses the creation of *Cloudy with a Chance of Meatballs 2*

40 Inside Unreal Engine 4
Discover what Unreal Engine 4 promises for next-gen consoles

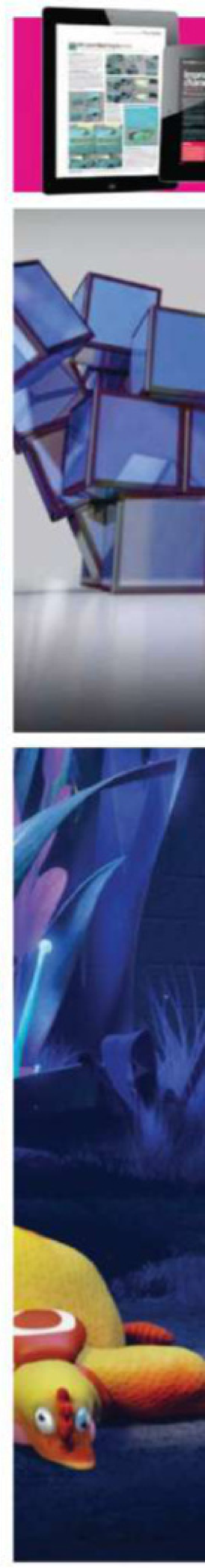
72 Subscribe today!
Save money with this special offer

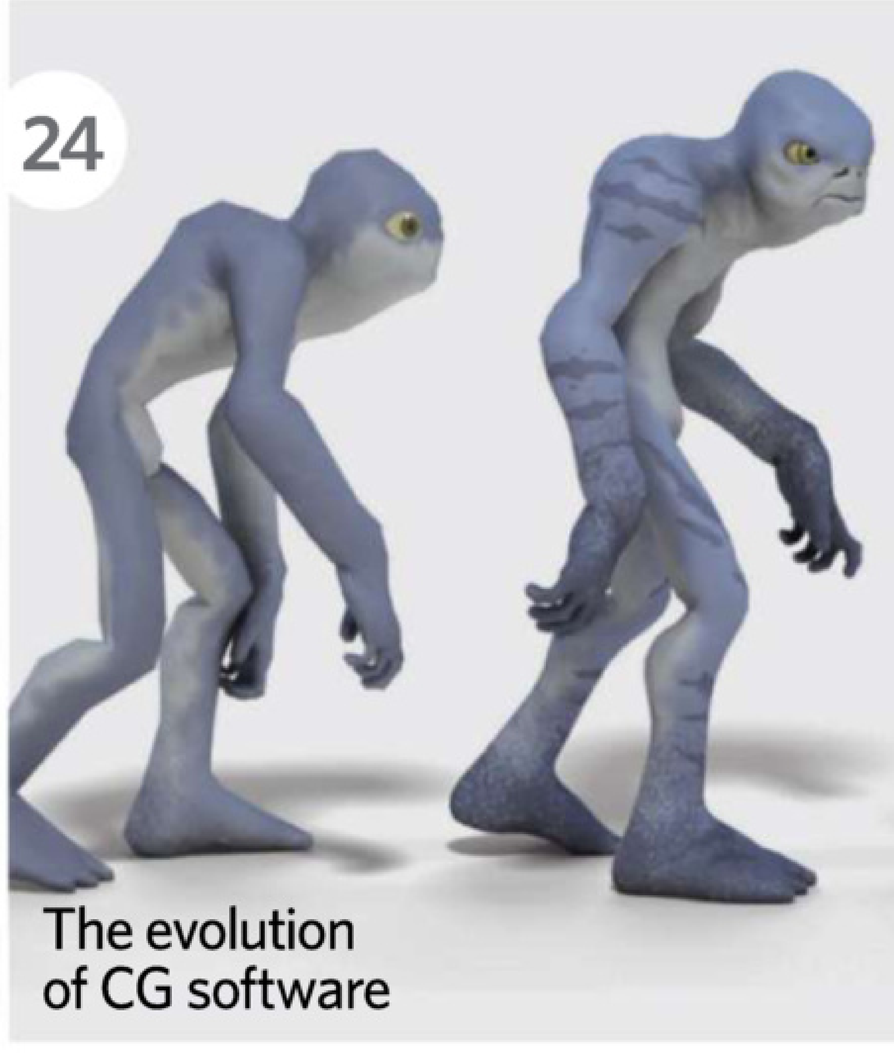
92 Head to head: Armari and Boston workstations
James Morris takes a look at two recent workstation releases

96 Review: ChronoSculpt
Discover why you should be trying out the 30-day trial right now!

97 Review: iClone 5.5
Reallusion's software continues to improve with this latest release

61
40
Inside Unreal Engine 4
"UE4 is designed to streamline the cross-discipline relationship on multiple fronts"
Alan Willard, senior technical artist at Epic Games, on the next gen of the engine Page 40





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Turn to page 90 for details

82

Discover ChronoSculpt

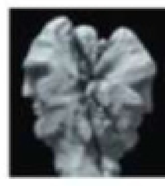
66

Texture and rig in Blender

The studio

Professional 3D advice, techniques and tutorials

48 I Made This: *Schism*
Albert Zablit discusses how his personal life experiences inspired this creative art piece



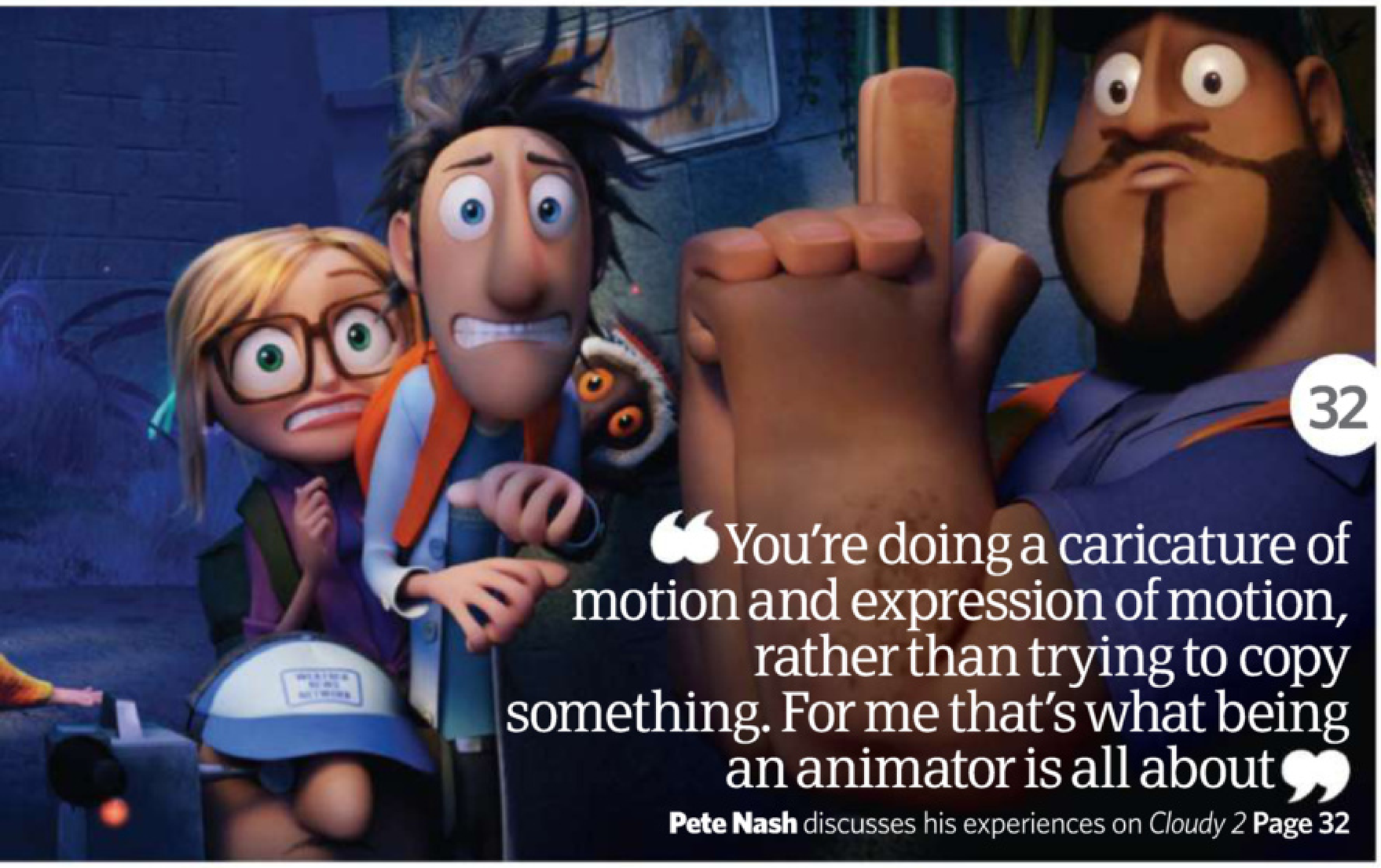
50 Step by step: Master hair and fur in ZBrush
Re-create Yasin Hasanian's awesome cover image

58 I Made This: *Slicer*
Einar Martinsen reveals how *Transformers* and Gnomon aided the creation of his image

60 Step by step: Build a city in 60 minutes
Generate realistic sci-fi landscapes using CityEngine

66 Step by step: Texture and rig in Blender
Jonathan Williamson continues his dinosaur-creation series

99 I Made This: *Gagarin*
Anton Turkin on how his nostalgic childhood memories influence his work



"You're doing a caricature of motion and expression of motion, rather than trying to copy something. For me that's what being an animator is all about"

Pete Nash discusses his experiences on *Cloudy 2* **Page 32**

The workshop

Expert tuition to improve your skills

74 Masterclass: Sculpt intense facial expressions
Chévon Leo reveals how to sculpt fear in ZBrush

78 Back to basics: Model a steam locomotive
It's part one of a new three-part Maya series from Jahirul Amin

82 Questions & Answers
This section is for users who have some experience of 3D and want to learn more

ChronoSculpt: Interchanges

FumeFX: Steam simulation

3ds Max: Vehicle rigging

Maya: Using OpenPipeline

workspace

Industry news, career advice & more

102 Industry news
Get up-to-speed with industry events

104 Studio Access: Squeeze
Discover how this unique animation studio operates

106 Project Focus: The Witcher 3
CD Projekt RED discusses next-gen game development

108 Industry insider: Pavel Dorokhovsky
Pavel reveals why he loves working at 4A Games

111 Course focus
Get into videogames with the Games Art MA course

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Turn to page 112 for the complete list of the disc's contents

WELCOME TO

THE GALLERY

Seven pages of great artwork from the 3D community

Images we love!

Artist info

Sofian Moumene

Sofian Moumene currently lives in Bucharest and has worked with 3ds Max for eight years

Personal portfolio site
www.sofianmoumene.com

Country Romania

Software used 3ds Max, V-Ray, Marvelous Designer

Work in progress...

"This was the first time I used Marvelous Designer. It's an excellent piece of software, which helped me a great deal in creating the drapes of the cloth of the table. Of course, it's not limited to creating drapes – you can simulate so much"

Sofian Moumene, *Wine Room*, 2012

"What an absolutely fantastic piece! This wouldn't look out of place in a gallery of classical art. It's a great example of using 3D software to create something beautiful"

Chris Deputy Editor

Have an image you feel passionate about? Get your artwork featured in these pages

Create your gallery today at **www.3dartistonline.com**

Or get in touch... 3dartist@imagine-publishing.co.uk @3DArtist Facebook.com/3DArtistMagazine

> I decided to do this piece based on a concept by Adam Ford. The idea was to take an image that has characters with personality and a contrasting feel to it. The silliness as well as the narrative of the image was something that made me to want to translate it to 3D

Leticia Tavares Reinaldo, *Never Trust a Skinny Chef,* 2013

Artist info

Leticia Tavares Reinaldo

Leticia is a character artist based in the US who enjoys evoking emotion from the viewer

Personal portfolio site
www.leticiareinaldo.com

Country USA

Software used V-Ray, Maya, ZBrush, Mudbox, NUKE, Photoshop

Work in progress...

> The impressive attention to detail and technical understanding of light interaction displayed in this image has resulted in an incredibly realistic match to the original photo. Great work!
>
> **Larissa** Staff Writer

Artist info

Jonathan Beals

3DArtistonline

Username: thebeals

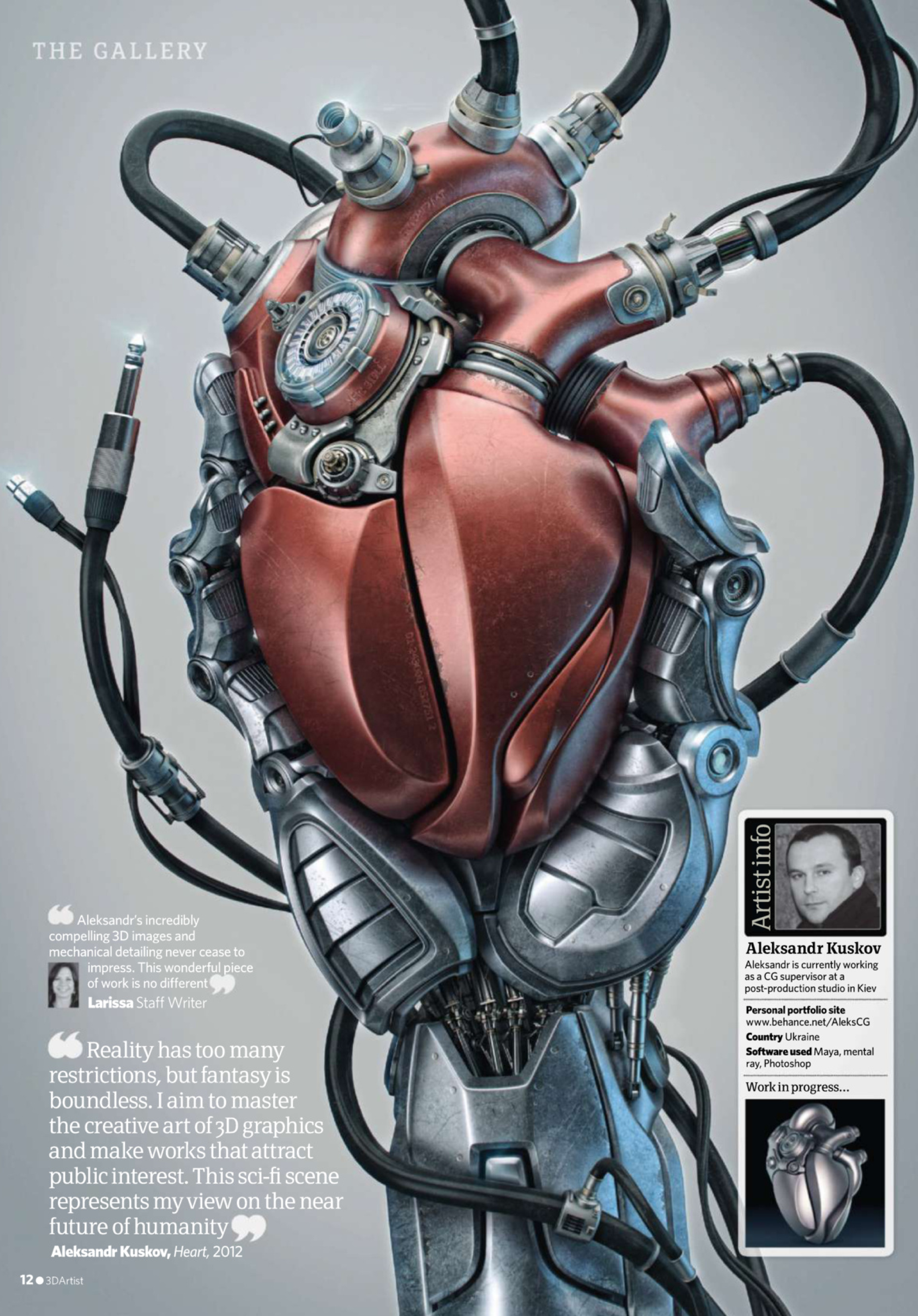
Personal portfolio site
www.jdbeals.com

Country USA

Software used 3ds Max, iRay, mental ray, Photoshop, After Effects

Work in progress...

> Since entering the VFX industry, I've been fascinated with artists who can mimic reality and create photorealistic art. I came across the 'Foo House' series by Apollo Architecture and immediately fell in love with the contrast between the concrete and wood and how the light played upon each
>
> **Jonathan Beals,** *Contemporary Living Room*, 2013



Aleksandr's incredibly compelling 3D images and mechanical detailing never cease to impress. This wonderful piece of work is no different

Larissa Staff Writer

Reality has too many restrictions, but fantasy is boundless. I aim to master the creative art of 3D graphics and make works that attract public interest. This sci-fi scene represents my view on the near future of humanity

Aleksandr Kuskov, *Heart,* 2012

Artist info

Aleksandr Kuskov

Aleksandr is currently working as a CG supervisor at a post-production studio in Kiev

Personal portfolio site www.behance.net/AleksCG

Country Ukraine

Software used Maya, mental ray, Photoshop

Work in progress...

“This image was created as a demo showcasing the use of a variety of different software packages and photographic techniques to develop a keyframe concept art piece. I shot a background at a concrete plant with the notion of adding myself and a bike within it”

Colie Wertz, *No More Gas*, 2012

Artist info

Colie Wertz

Colie has worked with film VFX for 17 years and is developing content with 3D Systems, Inc.

Personal portfolio site
www.coliewertz.com

Country USA

Software used Maya, V-Ray, MARI, Photoshop, Procreate

Work in progress...

“There's such a great sense of narrative evoked in this image. You can only imagine where the biker has come from and where he had wanted to go in this gritty futuristic world”

Larissa Staff Writer

“The inspiration behind the making of this image was from the news. There was a true story about a mother sent to visit her son in prison. I was so moved I tried to make a piece of work expressing this”

Hu Kai, *The Longing Visit,* 2013

“There are some seriously excellent skills on show here. The clothes are immaculately modelled, the lighting adds a great deal of atmosphere to the scene and the facial expressions provoke a huge emotional reaction”

Chris Deputy Editor

Artist info

Hu Kai

Hu is a lecturer on character creation, currently working in Mar Era, China

Personal portfolio site
http://wewe500.cghub.com

Country China

Software used Maya, ZBrush

Work in progress...

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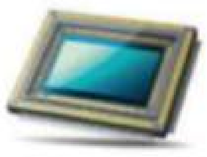

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Gravity © Warner Bros. Pictures, an Esperanto Filmoj/Heyday Films Production, an Alfonso Cuarón film - Courtesy of Framestore

The VFX Festival one year on

Escape Studios founder Dominic Davenport reveals what to expect from the newly expanded ten-day VFX program

After tickets to the event sold out in only 36 hours last year, London's VFX Festival, organised by Escape Studios, is set to return for its second year, from 4 to 13 of November.

This year the festival promises to not only be much bigger – having lengthened from a three- to a ten-day program – but also much more diverse. For 2013 you'll find everything from behind-the-scenes looks at the best-kept secrets of this year's biggest blockbusters, to an array of interactive workshops, showreel demos, talks and even an undisclosed, exclusive, Framestore-related screening all set to celebrate and explore the creative and technical skills behind the movie industry.

The line-up will feature talks from renowned VFX supervisor Alex Pejic (*Inception, Total Recall*), who will share his expert perceptions on the feature film *White House Down;* lead VFX supervisor Hugh MacDonald (*Skyfall, Hugo*) who will be breaking down the effects and techniques used in *Kick Ass 2;* and Cinesite's Eamonn Butler (*Iron Man 2, Harry Potter and the Order of the Phoenix*) will be offering creative insight into the world of animation.

There will also be several events focused on careers advice and progression, including an extended recruitment session led by recruiters from some of the industry's biggest post houses, such as The Mill, Cinesite, MPC, Double Negative and Framestore. There will also be a networking party for festival ticket holders on the closing night. Here we talk to Escape Studios founder and festival organiser Dominic Davenport, who also spoke to 3D Artist on the eve of the first festival last year, to find out more.

You told us in Issue 48, after first launching the Visual Effects Festival, that the potential evolution would be to add a film element to the events. How do you feel the festival has evolved since its inception?

Running from 4 to 13 of November, the VFX Festival is set to impress, inspire and inform enthusiasts and professionals from all corners of the globe

Top industry partners

Autodesk's Nick Manning on sponsoring The VFX Festival

"We are delighted to be involved with the London VFX Festival this year. London is a hub of cinematic excellence and this year we've seen the London VFX industry go from strength to strength. The last 18 Academy Award winners for Best Visual Effects have used Autodesk's software, so we have a vested interest in supporting the industry. The festival is a great opportunity for new businesses in this field to showcase their work and we are thrilled to support both seasoned VFX houses and start-ups."

After the success of last year's festival and seeing the appetite out there amongst young people for an insight into VFX, we extended the scope of the festival, creating more opportunities for people to engage with the varied components of this industry. There are a lot more workshops to choose from and by hosting the festival VFX screenings at the Vue Cinema in Leicester Square we can welcome a much larger audience.

As you can imagine, expanding the festival in this way was no easy task and was made possible purely by our generous sponsors - Autodesk, AMD, Creative Skillset, Chaos Group, Dell and Maxon - the driving forces behind the VFX industry.

What new highlights can festival-goers look forward to in this year's lineup?

The Future of Digital Creativity panel debate chaired by Danny Leigh (from the BBC's Film 2013), where Pat Joseph (CCO at The Mill), Antony Hunt (MD at Cinesite) Sir William Sargent (CEO at Framestore) and Samantha Perahia (from the British Film Commission) will discuss the best way to nurture future generations of VFX talent.

Top post houses on stage at Leicester Square's VUE cinema, showing us how they made the jaw-dropping effects on *Assassin's Creed*, *World War Z* and the major 2013 3D blockbuster *Gravity*.

A student showcase evening (Friday 8 November) where recent Escape graduates will be showing some of their best work for industry heads of VFX to critique.

An extended recruitment session led by recruiters from the best post houses – The Mill, Cinesite, MPC, Double Negative and Framestore – discussing what they look for in their artists. It's an exclusive opportunity for invaluable advice from the experts when applying for artist roles.

On the closing night we're concluding the celebrations with a networking party where festival ticket holders can mingle with like-minded CG enthusiasts and meet representatives from some of the best studios. It's a one-of-a-kind networking opportunity with the industry's best and brightest.

In what ways do you hope the festival will continue to progress and grow in the future?

Our aim for the festival is to keep evolving and keep offering a cutting-edge, dynamic programme of events that will encourage people to think differently about visual effects and get involved in the industry.

In the future we think it would be interesting to bring together a wider range of digital arts for cross-fertilisation and knowledge-sharing.

Festival organiser Dom Davenport. The 2013 festival will feature yet more behind-the-scenes presentations, revealing the mechanics and techniques being used on some of the industry's biggest shows

Cinesite VFX /Paramount Pictures
© 2013 Paramount Pictures. All Rights Reserved.

Gravity © Warner Bros. Pictures, an Esperanto Filmoj/ Heyday Films Production, an Alfonso Cuarón film - Courtesy of Framestore

> "We've increased the capacity of the sessions – last year demand was so high that tickets sold out almost overnight, so it's definitely bigger, bolder and better!"
>
> **Dominic Davenport** Escape Studios CEO

From 19 to 22 November 2013, over 7,000 artists, designers, researchers, manufacturers and developers, as well as trade visitors from all over the world, will convene at the Hong Kong Convention and Exhibition Centre

SIGGRAPH Asia 2013

This year sees the sixth annual SIGGRAPH Asia coming to Hong Kong, promising to showcase the best in animation as well as new virtual reality technology

From the 19 to 22 November, this year's SIGGRAPH Asia will not only be offering industry masterclasses, an art gallery and the Computer Animation Festival: it will also explore virtual reality and human-computer interaction, with both keynote speakers focusing on these topics.

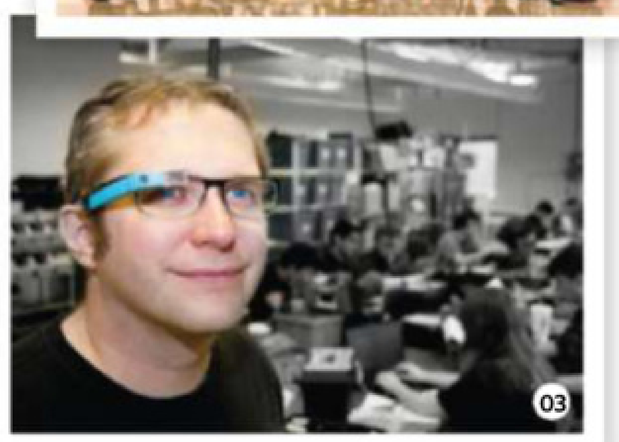
The first speaker, Thad Starner (technical lead of Google Glass), is the first man to fully integrate a wearable computer into his everyday life. With his talk, Starner aims to explore the future of wearable computers, using the most surprising examples from projects he's come across, such as Mobile Music Touch – a mobile wireless glove that helps the wearer learn new piano melodies – or CHAT, a wearable computer designed to enable humans to actually communicate with Atlantic Spotted Dolphins. The second keynote speaker will be Philip Rosedale, founder of the online virtual world *Second Life* and co-founder of High Fidelity, a company dedicated to exploring the very futuristic idea of an immersive, next-generation, 3D, virtual reality system. Rosedale's talk, The Revenge of Virtual Reality, will review the history and expectations of the technology.

For the first time SIGGRAPH Asia will also offer industry masterclasses from professionals such as the Academy Award-winning animator behind 'Paperman', John Kahrs, who discusses issues such as how to create an emotional impact using cutting-edge technology and bringing acting into contemporary animation to provide characters for the 21st century. Another full-day training session will be VFX in Creature Features – an MPC masterclass, led by animator Paul Chung, who has worked on films such as *Shrek* and will demonstrate the processes behind the VFX work in creature animation and techniques such as the differences between animating quadruped models as opposed to bipeds.

SIGGRAPH Asia 2013 will also feature an Art Gallery exploring the theme of Future/Past, a Trade Exhibition and The Computer Animation Festival. Additionally, the Technical Briefs and Papers programs will consist of new research such as 3-Sweep – an interactive technique to extract fully formed, simple, 3D geometry based on the objects within a typical photograph. The event will also incorporate a Synopsium on Mobile Graphics and Interactive Applications, which will include developments such as Mobile Virtual Archery.

For detailed conference program updates and more information about the event, please visit the SIGGRAPH Asia 2013 website at http://sa2013.siggraph.org.

> "Interactive technology has been one of the most important, inseparable wheels of SIGGRAPH"
>
> **Yoshifumi Kitamura SIGGRAPH Asia's Emerging Technologies director**



01 Mobile Virtual Archery, submitted by the University of Applied Sciences Düsseldorf, is a system that attaches a real archery bow to a mobile device

02 A highlight in the Technical Papers program, 3-Sweep: Extracting Editable Objects from a Single Photo (submitted by Tsing Hua University, The Interdisciplinary Center Herzliya and Tel Aviv University) introduces an interactive technique for manipulating simple 3D shapes by extracting them from a photograph

03 Visitors can meet the first man to fully integrate a wearable computer into his everyday life: the technical lead of Google Glass, Thad Starner

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'Roadkill Redemption'

Graduate of Ringling College of Art and Design, Karl Hadrika, takes us behind the scenes of his 2D/3D hybrid thesis film

"All the 2D animation was done on my workstation with TVPaint," says Hadrika. "Using Maya, I would import the line tests as sequential images fixed to a camera and work to match the 2D character with the 3D action"

What was the idea behind 'Roadkill Redemption'?
Back in high school, I accidentally hit a raccoon with my car on a midnight run to the convenience store. The ensuing guilt resonated into the creation of an actual story premise. An ill-fated ghost raccoon haunts Leah, his careless murderer. Nailing the story was always my first priority. It wouldn't matter how trim everything looked if the initial foundation wasn't strong. Many hours were spent revising the animatic before Maya was even opened.

What techniques did you use and what challenges did you face when combining 2D and 3D?
I knew the 2D process would take extra effort, so I designed the production to skirt around any non-essential steps. For example, the cel-shaded look omitted the use of Bump maps, displacement and fur. The ghost raccoon is basically a tailed flour sack while Leah's simplified construction enabled more cartoon pliability. I was very happy with the range of expressions I got from her. This was achieved through lots of customised facial blend shapes and implementing non-linear deformers.

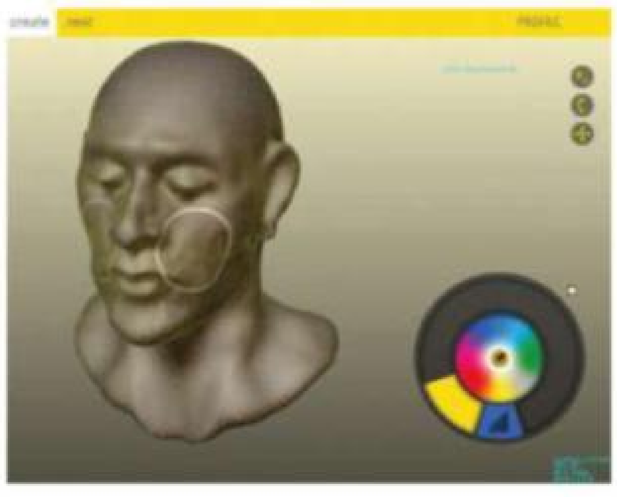
Before I knew it, the 2D ghost had been untouched for most of the second semester. He was a scribbled flurry, more or less, until the final month of production. I had to work in total isolation to binge-animate the rest of him. Obsession and deadline-induced paranoia drove me to the finish line.

In-browser sculpting

Easily sculpt 3D models for free, all within the comfort of your own web browser, with SculptFab and Leopoly

SculptFab is based on SculptGL – a browser-based sculpting application originally developed by Stéphanie Ginier as part of a previous C++ school project made at the University of Montréal. SculptFab enables users to sculpt in a web browser using seven different brushes. There are also five topology options and a range of different features such as negative sculpting and parameters such as Radius and Intensity. Models can be imported into the application as OBJ files as well as published to SketchFab in one click or downloaded as an OBJ file.

Leopoly hopes to bridge the gap between professionals and beginners of 3D design by providing an easy 3D-sculpting tool and community-based, game-like experience. It provides users with the ability to share creative designs and save them in a cloud-based gallery, as well as prepare files for 3D printing in minutes. The tool will also work in 3D mode and gives users the ability to paint objects online and sculpt using a specialised 3D mouse.



Visit **https://labs.sketchfab.com/sculptfab** to access the SketchFab tool, or **http://leopoly.com** to start using Leopoly and check out what others have made!

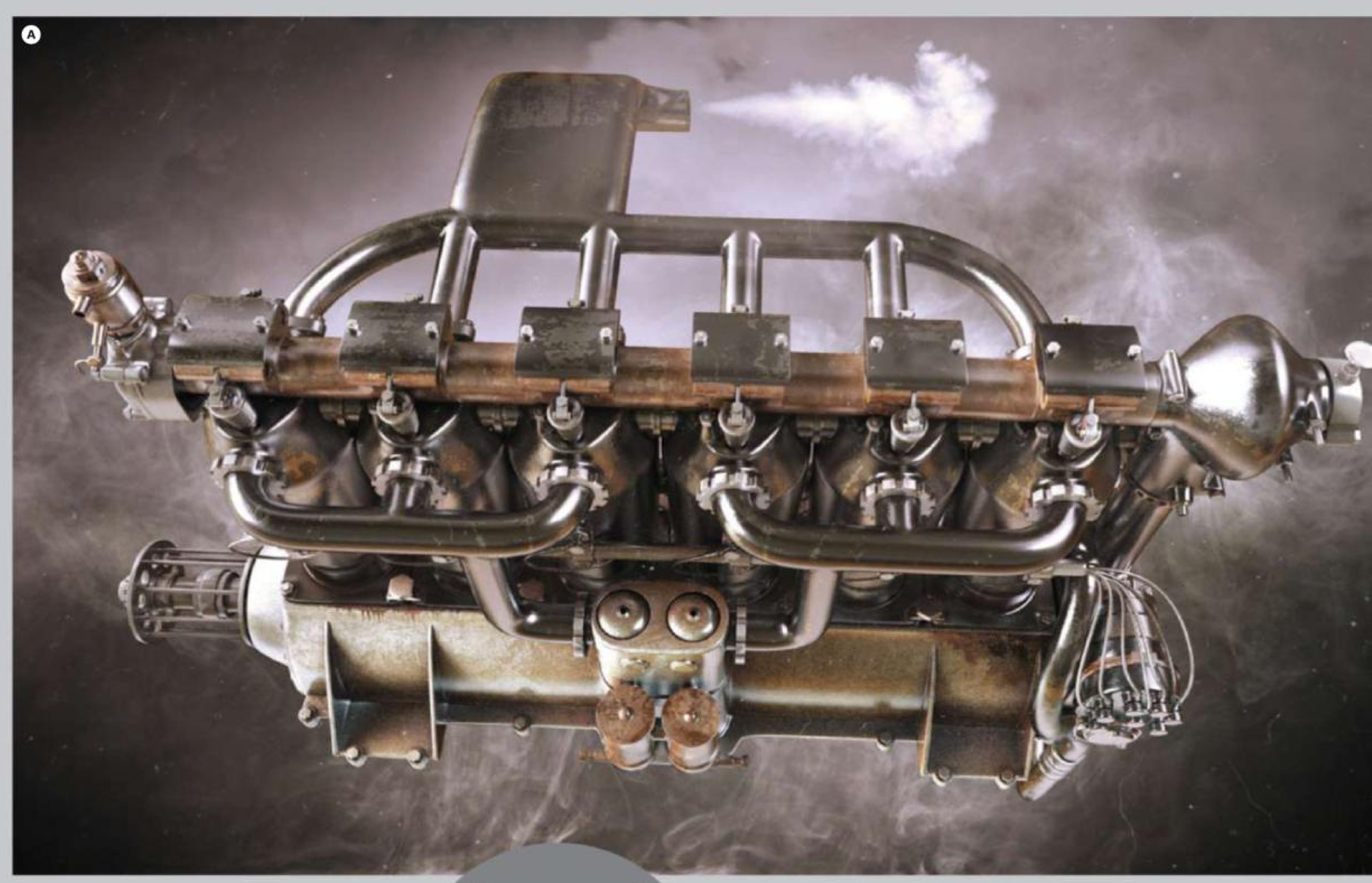
Five-minute aging

How Anthony Cerniello re-created the subtleties of the aging process using 3ds Max, After Effects and NUKE

"Every time I see a CG person, there's something off about it, there's always something slightly wrong," begins Anthony Cerniello. Taking his dislike of the Uncanny Valley effect – as well as the financial budget of the personal project – into consideration, Cerniello decided to base his new film, 'Danielle', on real photographs and video footage of several women representing various ages, from friend Danielle's family. His aim: to ultimately re-create the effect of a single person growing older as photorealistically as possible, so that the viewer barely realises it's happening.

After scanning the portraits into a drum scanner, Cerniello, along with animators Nathan Meier and Edmund Earle, worked in After Effects and 3ds Max to morph and animate the still photos after having wrapped them onto a simple face model. You can see the incredible short in full and find more of Cerniello's work on his personal Vimeo page: **http://vimeo.com/anthonycerniello**.

"The original scans of each picture were about 120MB, so they were pretty big," says Cerniello. One of the challenges of the project was morphing between the video footage and the detailed high-resolution scans. 'Danielle' has even received attention from the medical community as an example of what aging does to a person's features



Images of the month

These are the illustrations that have been awarded 'Image of the week' on 3DArtistOnline.com in the last month

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to view the art and chat to the artists

A Mercedes DIII engine
» **Alexandr Novitskiy**
3DA username Tigersfather
Alexandr says: "This is a six-cylinder, liquid-cooled, inline aircraft engine from the Mercedes DIII. I used VRayDirt to simulate old paint and rust on the model, which was created for an airplane I'm working on."
We say: *Once again Alex has shown off his creative ability, this time focusing on the nuts and bolts of mechanical interiors, rather than the sleek curves of vehicular exteriors. There's some great detailing going on here and the vapours surrounding the image are a nice touch.*

B Steampunk Ghostbuster
» **Pedram Karimfazli**
3DA username JohnnyRaptor
Pedram says: "I created this character for Industria Mechanika, to be 3D printed and cast for its steampunk competition as a prize for the winning costume submission. It was sculpted entirely in ZBrush and rendered with Maya and mental ray."
We say: *As ever, we're suckers for a bit of steampunk, so combine this with a flavour of one of our all-time favourite films and you're onto a winner! We love the detail on the steam-powered Proton pack.*

C Queen of the Sea
» **Damon Woods**
3DA username DK Woods
Damon says: "I wanted to convey the look of a woman who has been shaped by a harsh world and has somehow managed to come out on top."
We say: *We must say, it can become rather boring when every other woman rendered in 3D is a big-bosomed, scantily dressed beauty. How refreshing to see a female pirate that actually looks like a pirate – scarred, battle-worn and truly tough.*

D Traditional Toad Sculpture in CG
» **Jin Hao Villa**
3DA username Jin Hao Villa
Jin Hao says: "I tried to mimic an actual clay sculpture in this model's development, adding the imprints and other imperfections of clay to give it more believability. So, this is the finished CGI work of an unfinished real-life sculpture."
We say: *We love the imagination that's gone into this – something with a very tangible physicality modelled in the digital realm instead. Great work, from the toad itself to the stand that's keeping him upright!*

Image of the month

Octo

» **Andy Jones**

3DA username Andyjonescreative

Andy says: "You know that thing you draw when you're not really trying to draw anything? For me that's octopuses! This was a 3D interpretation of about a million napkin sketches."

We say: *When we're doodling we always end up drawing cartoon dogs! But our attempts are hardly as effective as this deep-sea flesh bag. You can almost feel its damp, squishy skin just by looking at it!*

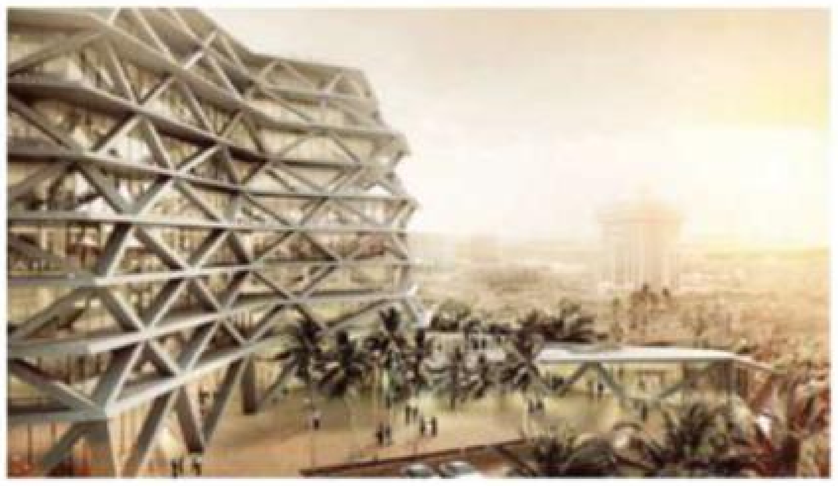
Loom

» **Armin Primig**

3DA username nbeyond

Armin says: "I was inspired by *WALL-E* and wanted to make something similar. I'm also a fan of *Transformers*, so I decided to mix a little of those two things together. The result was this guy!"

We say: *Maybe it's just us, but we're getting a sense of* Short Circuit's *Johnny Five here too... It must be the track pads and the large eyes! This is a great piece of work, with some fantastic use of reflections.*



One Airport Square

» **Cristian Chierici**

3DA username ccsettantanove

Cristian says: "This project was an architectural visualisation that I created for MCA – Mario Cucinella Architects."

We say: *We love the design of the building here. It's geometrically complex, but still conveys a sense of immediacy and simplicity.*

Swordsman

» **Hu Zhixing**

3DA username huzhixing110

Hu says: "This is my recent work of an Oriental swordsman. The model work was completed in 3ds Max and ZBrush, the texturing was done in Photoshop and rendering was done in V-Ray. I created the hair using Ornatrix."

We say: *You can almost feel the menacing power of this character emanating from the page. The artist has managed to communicate menace and danger alongside a sense of cool, steady calm, which is quite an achievement!*

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Have your say

Email, Tweet or get in touch with us on Facebook to share your thoughts, opinions and proudest projects

Top tweets

Get involved... **@3DArtist**

@AniAppTweet Congratulations to Team UULA who won the Best Concept Design category from @3DArtist at the @BFXFestival! Well done guys!

@benjaminsohn @NeillBlomkamp is a very smart guy. Watched #Elysium tonight – great story and very nice VFX and also very nice interview in @3DArtist

@henningsanden I got a little something from the guys at @3DArtist in the mail just now. Neat.

On the Wall

Facebook.com/3DArtistMagazine

Huge congratulations are in order to the award winners of the BFX competition. We were proud to present the award for Best Concept Design to team UULA! Check out the amazing films produced in only six weeks at bfxfestival.com/bfx-final-films-2013

If you want to have your work or thoughts displayed here, get in touch with us via email at **3dartist@imagine-publishing.co.uk**, via Facebook at **facebook.com/3DArtistMagazine** or on Twitter **@3DArtist**

Social media images of the month

Mike Mitchell's MacReady **Facebook likes** 418
» **Willem-Paul Van Overbruggen • Portfolio** http://slid3.cghub.com
Willem-Paul says: "I'm a great fan of *The Thing* and I was in awe of my buddy Mike's original illustration so I re-created it in 3D. I modelled with subdivision surface techniques and a ZBrush pass for final details. Rendering was done in V-Ray and compositing in After Effects."

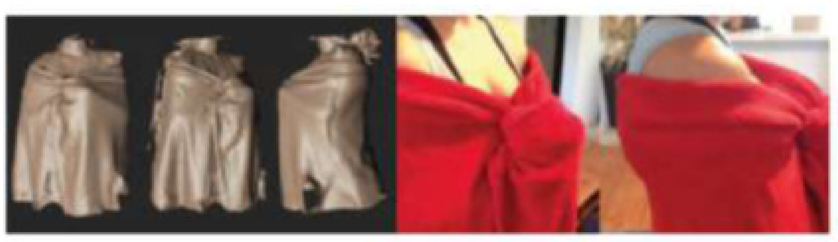
Dwarf **Facebook likes** 761
» **Jorge Lopes**
Jorge says: "I decided to make a dwarf in 3D not long after I saw the film *The Hobbit*. I was super excited about the various characters in the film, and wanted to make my own version of a dwarf. I created the image using 3ds Max, ZBrush, V-Ray and Photoshop."

3D scanning

Hi Chris, I've been quite interested by the recent surge in interest in 3D-scanning technology as of late. I've come across everything from handheld scanners that can capture small objects, to huge machines that can accurately capture the dimensions of an entire environment. However, being a student with little in the way of funds to my name, I was wondering if there were any cheap alternatives I can use when working on projects of my own? Thanks,

Leigh, via email

The cheapest option for you right now would likely be 123D Catch by Autodesk, which you can actually use on your smartphone. It creates rough 3D models that you can tweak to perfection, all for the low price of £0! Dan Roarty used it in issue 60 to capture the blanket wrapped around his female character and it worked well.



YOUR TOP WALL POSTS

Da Vinci's Legacy
» **Arthur Jing**
3DA username saberArtorias
Arthur says: "This is based on Da Vinci's design of the robotic knight – an armoured robot operated with pulleys and ropes so it would move like a human. This piece expresses the moment when the knight comes to life and is examining his newfound body."

Pyramid House
» **Juan Carlos Ramos • 3DA username** Juan_Carlos_Ramos
Juan Carlos says: "I made this project for an architectural competition. The design, render and post-production was completed by me. I used 3ds Max, V-Ray, Itoo Forest, Photoshop and After Effects."

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THE EVOLUTION OF CG SOFTWARE

From early wireframes to Avatar, Larissa Mori talks to the pioneering founders of the most prominent CG software, finding out where the tools came from and how they got to where they are today

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Will Anielewicz
Head of computer animation at Omnibus. Early work at Alias working on PowerAnimator

Jim Blinn
Inventor of Bump-mapping, the Blinn-Phong shading model. Researches realistic rendering

Kim Davidson
Co-founder, chief executive officer and president of Side Effects Software Inc.

Greg Hermanovic
Founder of Derivative and co-founder of Side Effects Software Inc.

Tom Hudson
Main developer of 3D Studio, as well as its precursors and prototypes (Yost Group)

Tilo Kühn
Senior developer and programmer of CINEMA 4D at MAXON studio

Chris Landreth
Hired to define, test and abuse software such as Maya. Has Oscar-winning animation work

Philip Losch
Senior software engineer at MAXON. Co-writer of the precursor of CINEMA 4D

Terrence Masson
Author of *Cg101: A computer Graphics Industry Reference*. Technical director at ILM

Rob Powers
President of the LightWave 3D Group, a division of NewTek Inc, with numerous film credits

Fred Ruff
Lead designer for 3ds Max. Worked with the original creator of 3D Studio (Bent Image Lab)

Gary Yost
Leader of the Yost Group, which created and developed an early version of 3ds Max

The evolution of CG software

We may not think about it often, but it's difficult to go even one waking day without some form of CG somehow making its way past our eyes. Whether in adverts, music videos, YouTube streams, screensavers, or any other number of computer-generated imagery, the art form has fully entrenched itself in our day-to-day lives. Strange then, to think that just 50 years ago there was effectively no such thing.

By the late 60s, the few computers in the world capable of producing any form of line-drawn animation cost the equivalent of nearly $700,000 today, were the size of a bunk bed and used only paper tape. Even computer science itself was so unheard of that when computer graphics pioneer and inventor of Bump-mapping Jim Blinn attended the University of Michigan in 1967, it wasn't even offered as a subject.

However, during the early 70s, hubs like the University of Utah began to showcase 3D imagery produced by pioneers such as Blinn. There were early examples of shaded 3D CGI, produced with frame-buffers for display on TV monitors, and even the first 3D, computer-animated graduate shorts like 'A Computer Animated Hand', created by Fred Parke and future Pixar founder Ed Catmull. Nevertheless, CG remained something only a programmer could realistically develop for some time to come.

Also, bizarre by today's standards, special effects in the movie industry were by no means prevalent. In fact, when George Lucas began to produce *Star Wars* in 1973, he quickly discovered that the Special Effects Department at 20th Century Fox was actually no longer operational.

It was in order to create the effects required to match Lucas' vision that Industrial Light and Magic was born in 1975, and the result of its work is hailed today as one of the first examples of the modern-day blockbuster. *Star Wars* even included 3D effects. A year after a brief 3D-digitised representation of a face and hand was first seen in *Futureworld*, 1977's *Star Wars Episode IV* contained the first truly extensive use of 3D computer-generated imagery and animation ever seen in a feature film, during a very basic, untextured wireframe sequence of the Death Star trench.

"Larry Cuba, back in the 60s and 70s, single-handedly completed the wireframe of the Death Star simulation in the original *Star Wars*," explains Terrence Masson, author of *CG101: A Computer Graphics Industry Reference*. He tells us that by 1982, ILM had produced the first entirely computer-generated sequence for *Star Trek II: The Wrath of Khan*. Barely a month later a huge 20 minutes of full 3D CGI created by Information International Inc, Robert Abel and Associates, MAGI and Digital Effects was revealed within Disney's *TRON* release.

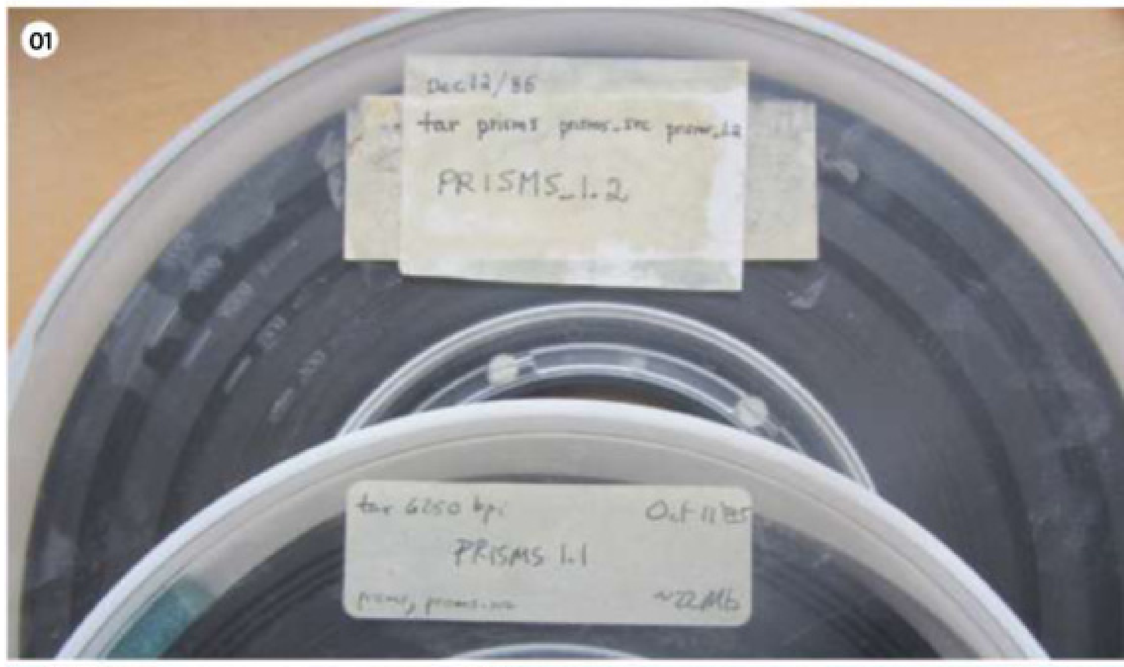
It was only a matter of time before commercial software companies with products made specifically for computer-generated imagery started to trickle into the public sphere, with many co-developing their software together with the in-house software at successful studios such as ILM. As the hardware also began to lower in price, the early 80s marked the introduction of the first startups, as well as successes and failures of businesses such as Autodesk, Alias Research, Wavefront and Omnibus

HOUDINI & PRISMS

"My big break came in 1985," begins Kim Davidson. "I was hired at Omnibus Computer Graphics in Toronto as a programmer, helping it develop its internal 3D animation software." The largest computer graphics company in the world, Omnibus was already using mainframe computers to create flying logos and station IDs as well as boasting state-of-the-art computer animation studios in Toronto, New York and Los Angeles. It was here that Davidson first met Greg Hermanovic who, after a background as a programmer working on everything from real-time flight simulators to a training simulator for the Space Shuttle's robot arm, was hired as the new head of the Toronto R&D team. Together, they began developing the early version of Houdini's predecessor: Production of Realistic Image Scene Mathematical Simulation, or PRISMS. However, their time at Omnibus was short-lived. In 1987, after having swallowed both Digital Productions and Robert Abel & Associates, the company that had seemed so powerful suddenly went bankrupt under the weight of its many debts.

"I don't think of myself as entrepreneurial, or a risk-taker, but I loved it so much that when Omnibus went bankrupt in 1987, I didn't hesitate to jump into starting a company so I could continue working on computer graphics in Toronto," explains Davidson. "There was nothing close to what we had created at Omnibus and that was the reason for starting Side Effects."

Luckily, the struggling Omnibus had licensed PRISMS to other companies in order to bring in extra revenue. This meant that when Davidson and Hermanovic acquired the rights to PRISMS, they had their first licensed customers right from the start.



Kim Davidson was hired by Omnibus Computer Graphics in 1985 and went on to found Side Effects Software in 1987

CG software: a few key events

1968 First public demonstration introducing the computer mouse by Doug Englebart of SRI

1968 Evans & Sutherland founded, marking the first computer graphics company

1969 UNIX operating system developed by Kenneth Thompson and Dennis Ritchie at Bell Labs

1972 'A Computer Animated Hand', a short by Ed Catmull and Fred Parke, is developed at the University of Utah

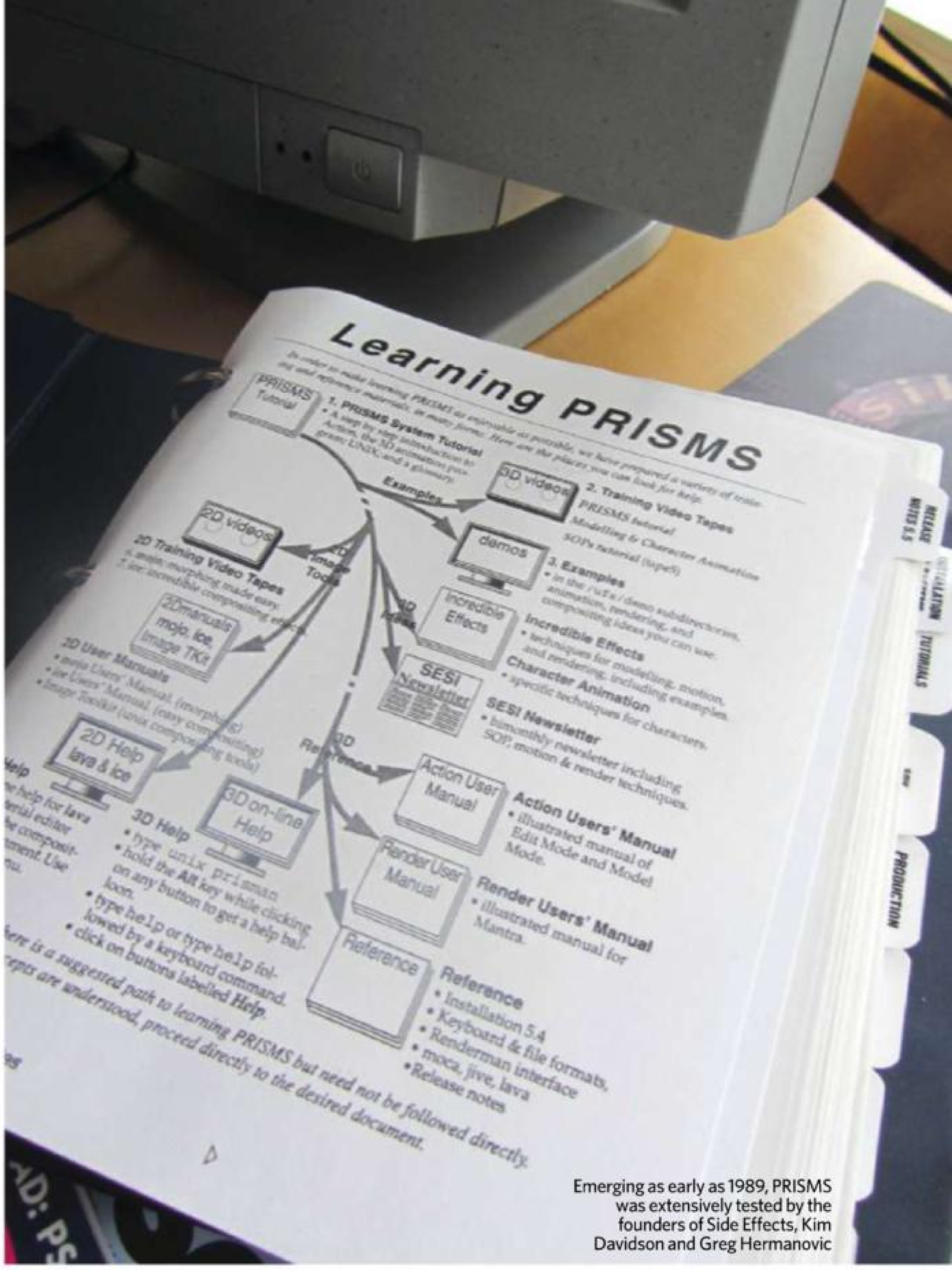
"By the end of the 60s it got advanced enough that people began realizing it had **potential outside the research lab**" **Terrence Masson**

01 "The procedural version of PRISMS started to see the light of day around 1989," explains Hermanovic. "It became popular because it automated and visualised what CG artists were already doing blindly"

02 PRISMS also included Mojo, a morphing package, as well as motion-control interface Moca and ICE

03 The Omnibus team in 1987. The struggling company had licensed PRISMS to companies in Japan and the UK a few months earlier, so when Davidson and Hermanovic acquired the rights they already had their first licensed customers

04 SIGGRAPH 1993



Emerging as early as 1989, PRISMS was extensively tested by the founders of Side Effects, Kim Davidson and Greg Hermanovic

The need to innovate

"It's amazing how many advancements have happened in computer graphics over the last 25 plus years. Mobile phones have graphics capabilities that far exceed the early graphics workstations and at a fraction of the cost and size," says Kim Davidson, co-founder and president of Side Effects. "However, I'm frustrated that Side Effects and the industry aren't further than we are. There were animated CG humans 25 years ago... The industry is just doing more a lot easier, but I don't think we are doing it a whole lot better. The majority of animation is still done by an animator sitting with a mouse moving a limb and creating a keyframe and it's still nearly impossible and expensive to create photoreal CG humans. John Pennie, president of Omnibus, said in 1986 that in two years we would be creating CG humans that were indistinguishable from real actors... I knew it wouldn't be two years, but I thought it would be a reality 27 years later. So for all the accomplishments we have obtained, there's still lot to do. That's exciting to me and that continues to be our motivation."

> NEW STUDENTS ARE BETTER IF THEY UNDERSTAND THE EVOLUTION OF THE SOFTWARE AND WHAT'S BEEN MADE WITH IT – THAT'S ABSOLUTELY CRITICAL
>
> **TERRENCE MASSON,** independent VFX supervisor

In their first years running Side Effects, the co-founders continued to not only keep coding the software but also to use and test it themselves as a production company, which enabled PRISMS to improve all the more quickly. "The procedural version of PRISMS started to see the light of day around 1989," explains Hermanovic. "It became popular because it automated and visualised what computer graphics artists were doing blindly and non-interactively before." With their client base growing rapidly, the pair soon made the decision to pull away from production to focus solely on developing the software, and by the 90s PRISMS had been used to produce the visual effects for feature films as impressive as *Apollo 13*, *Twister* and *Titanic*. Yet despite this success, Side Effects had long been thinking about where to take the software next.

"Although Houdini 1.0 shipped in December of 1996, we had started the design of Houdini in 1991," reveals Davidson. The 90s saw the start of exponential growth in the 3D industry thanks to further advancements in affordable graphics and, all of a sudden, Side Effects found itself in competition with three public companies all vying for a market share. With Houdini, the co-founders aimed to shift from PRISMS' C to C++ and take advantage of the advancements in hardware graphics. However, they also made the conscious decision to switch tactics, rising above the competition by focusing on a segment of the market where they felt they could make the most difference: film VFX.

"It was a good move for us," Davidson concludes, something that is more than clear, given that Houdini is now used by leading film studios and Side Effects has won three Academy Awards in recognition of its phenomenal work. "The inspiration for PRISMS was to create efficiencies for ourselves, as clients are *always* changing their mind. It's satisfying to see how well the overall architecture and procedural paradigm has stood the test of time. While we have rewritten some big chunks of Houdini and added tons of features, the basic architecture and data flow have remained the same."

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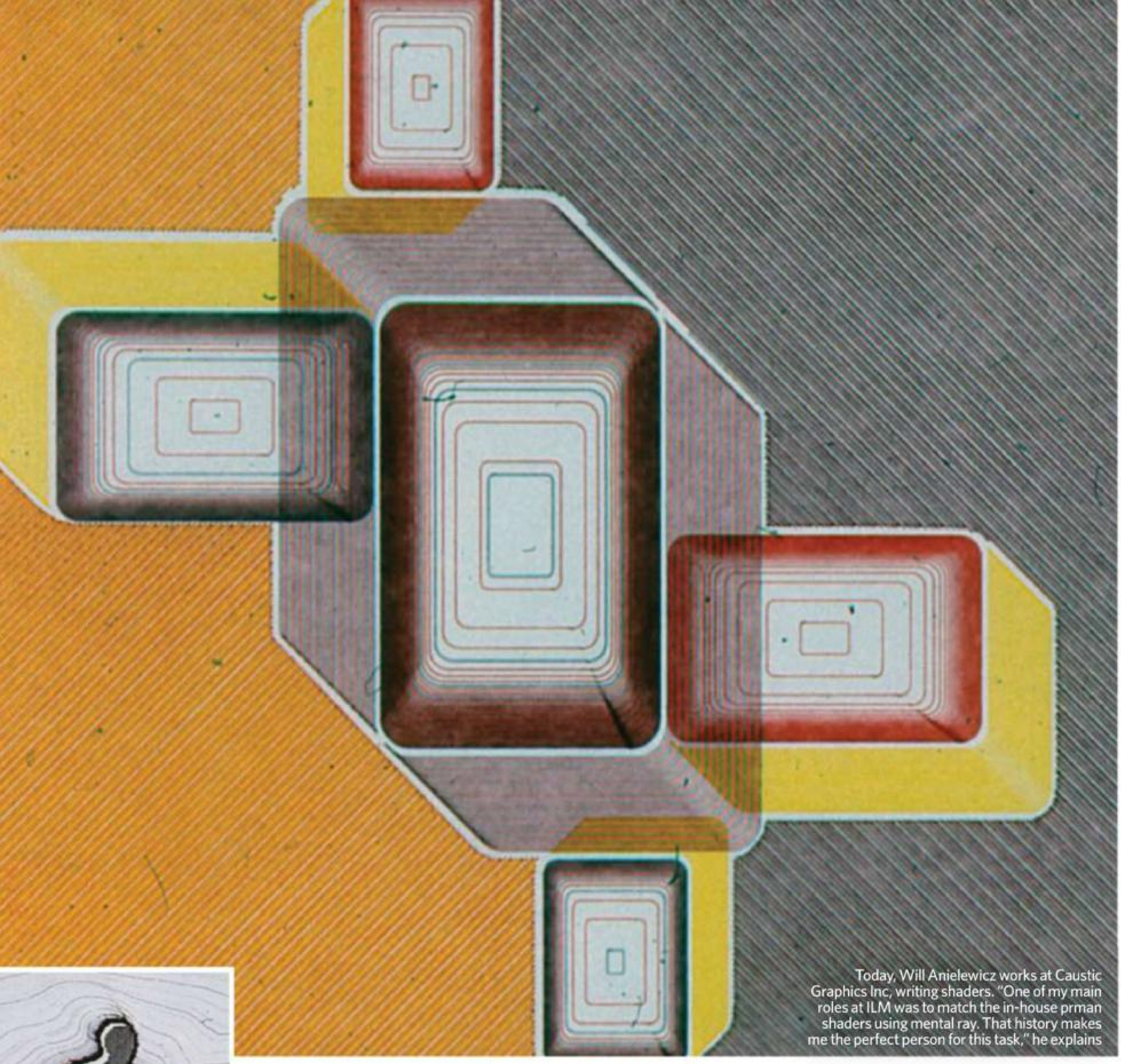
1974 AMC-SIGGRAPH, the special interest group of the Association for Computing Machinery, is first established

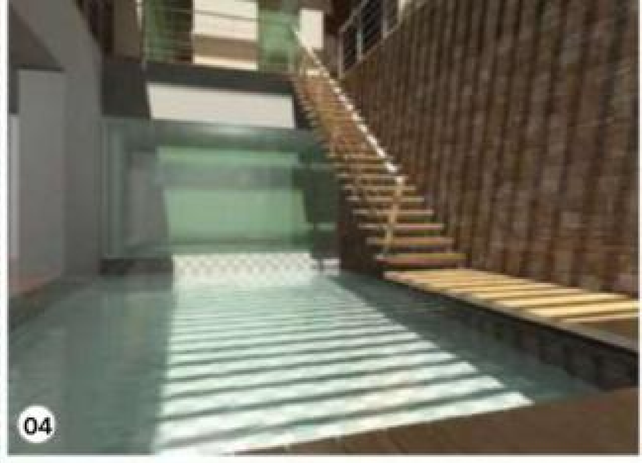
1975 Martin Newell develops the now famous *Utah Teapot*, now one of the most iconic images in the world of CG

1978 Bump-mapping is introduced by Jim Blinn and Martin Newell

"The other big milestone probably was the **explosion of commercialisation** in the 70s" **Terrence Masson**



Today, Will Anielewicz works at Caustic Graphics Inc, writing shaders. "One of my main roles at ILM was to match the in-house prman shaders using mental ray. That history makes me the perfect person for this task," he explains



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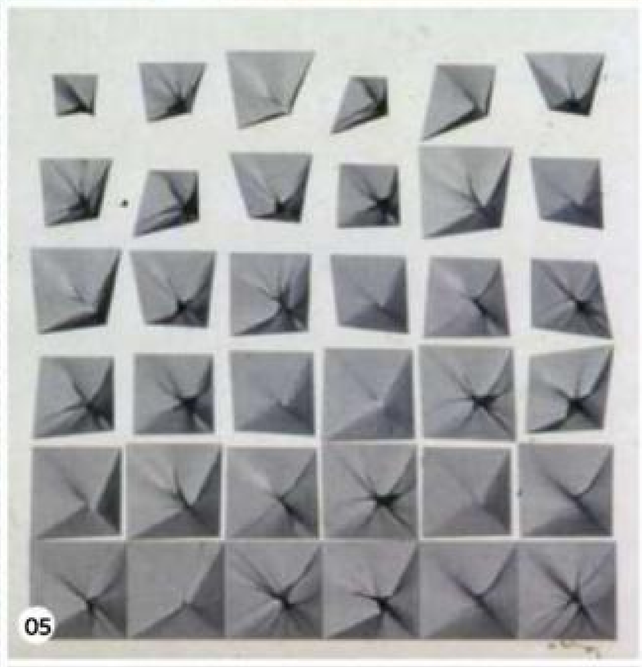

05

06

04 *Interior Pool* by Ryan Montrucchio and Will Anielewicz, Geometry: Tasso Ringas and George Nikopoulos; Software: Caustic Visualizer for Maya

05 An example of plotter art by Will Anielewicz, created from 1976-79

06 Image from 'Subconcious Password,' Chris Landreth's latest short film, which he created using Maya

MAYA & ALIAS 1

Before Greg Hermanovic took over as head of R&D at Omnibus, Will Anielewicz had the job. After studying a Masters program – during which his computer science advisor declared his project was not viable due to there being no future in computer art – Anielewicz set out to prove him wrong. "In 1979 I was hired by Omnibus Video to head up its Computer Animation division," he tells us. "Although I knew nothing about animation, they hired me anyway since they got no replies for their ad: 'Required: Experienced computer animator.' I was the only employee for almost the first year."

It was only three years later, when Omnibus was becoming a powerhouse, that he first heard of a tiny startup founded by Stephen Bingham, Nigel McGrath, Susan McKenna and David Springer, named Alias Research. "They welcomed me with open arms. I now had three years of experience in computer animation, which in those days was a relative lifetime," Anielewicz explains.

Working in a run-down warehouse where the computers doubled as room-heaters during Toronto's harsh winter months, a lack of funds lead to a new change in focus: Alias 1. The team aimed to produce a system that would enable users with minimal training to achieve complex computer animation. However, in 1985, Alias signed a landmark deal with car manufacturer GM, receiving a sizeable investment out of an interest in using the spline-based software for design instead. "I created the first prototype graphic interface for this system in a few days," Anielewicz says. "Our first demo was mostly smoke and mirrors but we won the contract."

Chris Landreth was hired and started working at Alias in 1994. "It was a good time to start because the company really wanted to show its potential market that the software it was developing could be used to do production." Alias' profits had soared throughout the late-80s and early 90s, as its second- and third-generation Alias and PowerAnimator software began to be used for Academy Award-winning VFX on films such as *The Abyss, Terminator 2, Jurassic Park, Forrest Gump* and *The Mask*. "What my job turned into was to use Alias' developing software – which was later to become Maya – in an actual animated film to test the software," Landreth continues.

In 1995 Silicon Graphics bought Alias Research and Wavefront Technologies, merging the two companies. Landreth spent the following year developing multiple new Maya features, putting them to the test on his short film, 'The End', which in turn earned him an Academy Award nomination. In 1998, the new Alias|Wavefront merger finally released the first version of Maya, which quickly became a new industry standard. The team continued to develop it until 2006, when Autodesk acquired the company. "I

> "I HAVE ALWAYS THOUGHT OF MYSELF AS AN ARTIST. THE COMPUTER IS BOTH MY BRUSH AND COLOUR PALETTE"
>
> **WILL ANIELEWICZ,** software engineer, Caustic Graphics Inc

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1980's

1982 Autodesk is founded in CA by John Walker

1982 20 minutes of full 3D CGI released within Disney's *TRON*

1983 Jim Blinn receives the first ACM SIGGRAPH CG Achievement Award

1983 Alias founded in Toronto by Stephen Bingham, Nigel McGrath, Susan McKenna and David Springer

1985 NewTek founded by Tim Jenison

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really did not expect Maya to still be in use," reveals Anielewicz. "It's been almost 30 years. I use it every day."

3DS MAX & 3D DOSR1

"I'd been going to SIGGRAPH since 1986, drooling over the SGI Iris workstations and software from companies such as Wavefront, Alias and Vertigo," begins Gary Yost. "However, those solutions cost upwards of $40-50,000 at the time and were totally unavailable to mere mortals such as my friends and I."

Yost had already founded Antic Software in 1984 and, together with fellow developer Tom Hudson, had been working on the creation of a set of 3D tools, before becoming limited by the graphics their budget could afford. Then, in 1987, they were asked if they would be interested in developing 3D software for the PC under license to the ever-growing Autodesk.

By 1988 the Yost Group was formed with Gary Yost at the helm. The small team began working on a modelling and rendering application internally, code-named THUD after Tom Hudson, who was the only programmer on the project. Impressively, the first version of 3D Studio DOS was released only two years later. "The response to DOSr1 was huge," remembers Yost. "There was just a lot of pent-up demand for something like that. Once it took off, we just got on the train and didn't look back."

There were two huge shortcomings with 3D Studio DOS. There was no Undo function and there was a lack of animatable controls, meaning that once the user created something, the mesh would be fixed aside from scaling, rotation or morphing. The core group made up of Yost, Hudson, Dan Silva, Rolf Berteig, and Don Brittain were soon joined by Mark Meier and Gus Grubba. They spent the next seven years working to rewrite the entire code base of 3DS DOS, leaving what would become 3ds Max.

"We were motivated by a lot of things, not least of which was our royalty-based licence with Autodesk," says Yost. "We were in our 30s, so if what we did become popular we'd see enough financial reward to make all the intense work worthwhile. We were on what we called a 'deferred life plan' for so long."

In addition to the extra funds a royalty agreement brought, the team were also motivated by their users. At the start of each 18-month development cycle, Yost would spend three months collecting feedback to help develop the feature set for the next version of the software, before embarking on development over the next 14 months. "That enabled me to rapidly develop ideas for new features. Tom, Don, Rolf and Dan took every suggested function as a personal challenge. I don't remember any of them ever telling me that something couldn't be done. Our motto was 'it's only software, so why not?'"

Each member of the group worked from home in different cities, sending data files back and forth over slow modems. The main goal for the developers was to essentially democratise 3D software, making it possible for creative people who were working for others to be able to begin working for themselves. "I think a huge part of 3D Studio's legacy that continued into 3ds Max is the concept of making easy-to-use software that is priced at an affordable level," explains Hudson. After unveiling the new software at SIGGRAPH in 1995 to a shocked audience, the Yost Group delivered 3ds Max in 1996. By 1997 the team decided it was time to start living out their previously deferred life plan.

"Between 1997 and 1999 we transitioned the code to a great in-house development team at Autodesk and then went on to other things," Yost continues, "I tear up a bit when I recall how exciting it was to wake up every morning after only four hours sleep and get to work. Never did so few developers make so many people so happy."

Giving up on 3ds Max

"In 1994, when we started writing code in earnest, our source code control/versioning system was running over analog modems from a server in Don Brittain's house," explains Gary Yost, leader of the Yost Group. "Within the first two months of development it was obvious that dialup was too unreliable for us to share code in this way." Incredibly, by September the developers had almost given up work on 3ds Max. "I had a conversation with Autodesk's then-CEO Carol Bartz in early October, saying that I thought we'd have to give up the project unless we could figure out something else to do," says Yost. "Just that week, Gus Grubba found that the new Integrated Services Digital Network (ISDN) system was being deployed nationwide and that it would support what we needed. Between October and December we were able to get the brand-new ISDN service and that solved the problem, enabling us to get on with development in earnest in January. What's amazing is that only seven months later, at SIGGRAPH LA in July, we unveiled Max along with the Character Studio/Biped plug-in by Michael Girard and Susan Amkraut. Max was kept secret until then and nobody expected us to ditch all of our 3D Studio DOS code."

> "WE ALWAYS SAID THAT WE WERE TRAINING OUR USERS TO BECOME MUTANTS WHO WANTED TO PLAY GOD, CREATING WORLDS WITHIN THE COMPUTER"
>
> **GARY YOST,** leader of the Yost Group

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07 "This is my character, Klanky the Robot, with the cornerstone character from my first 3D Studio DOS animation, 'Corner Stone'," says Hudson. "The animation was created with a pre-release version of 3DS DOS and I had thought the scene files were lost, but I found them in 2010."

08 "I felt like a roadie working with rock stars! I remember Gary Yost and his Hawaiian shirts," says Fred Ruff, who worked as a lead designer for 3ds Max and created this image using an early version of the software

09 Right after the launch of Max at SIGGRAPH in 1996. From left to right: Jack Powell, Don Brittain, Rolf Berteig, Mark Meier, Martin Doudoroff, Gary Yost, Dan Silva, Kyle Peacock, Tom Hudson. Missing is Gus Grubba

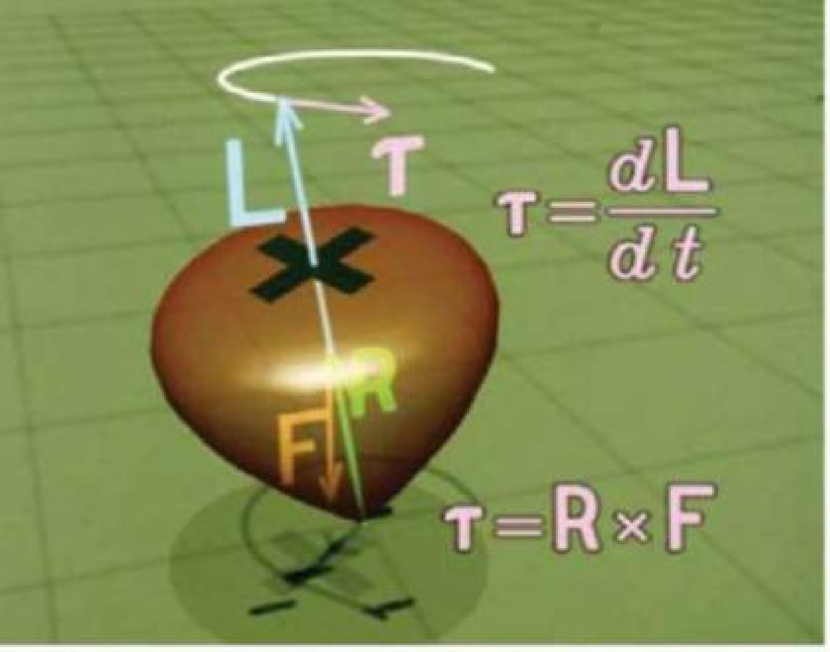
1986 MAXON formed by current CEOs Harald Egel, Harald Schneider and Uwe Baertels

1986 Steve Jobs purchases the Computer Graphics Division from George Lucas and establishes Pixar

1987 Omnibus caves to crippling debt and files for bankruptcy

1987 Side Effects Software established

1988 Yost Group formed with Gary Yost at the helm



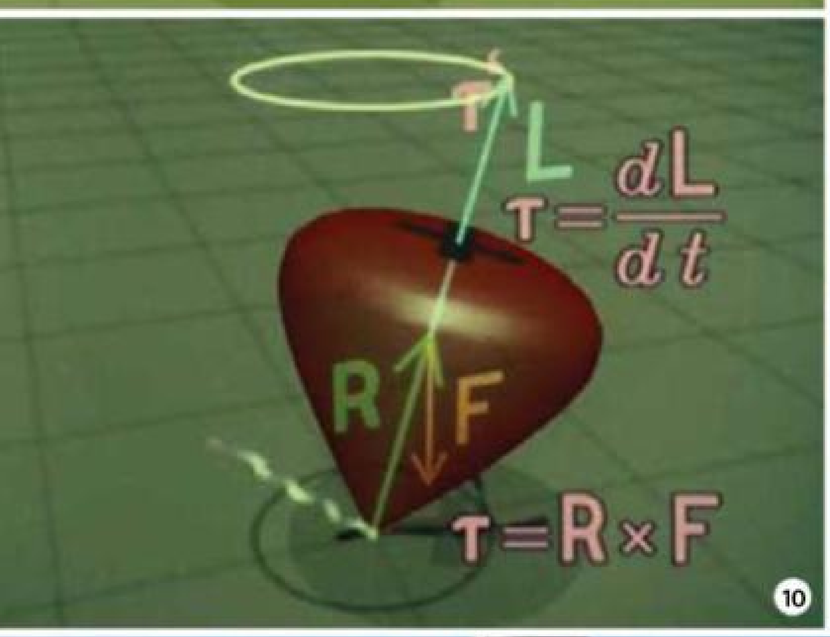


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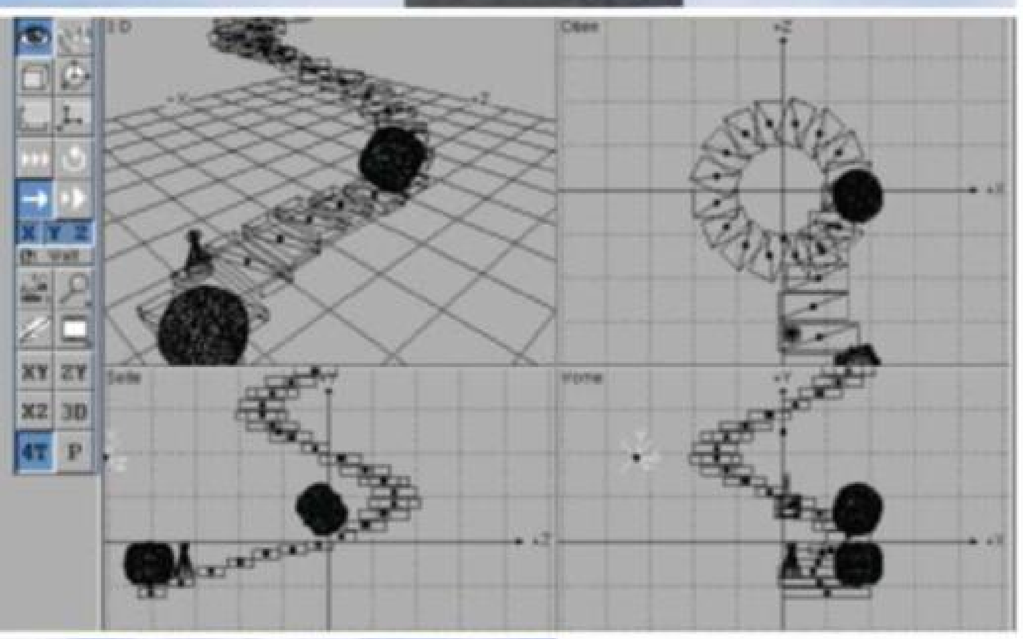
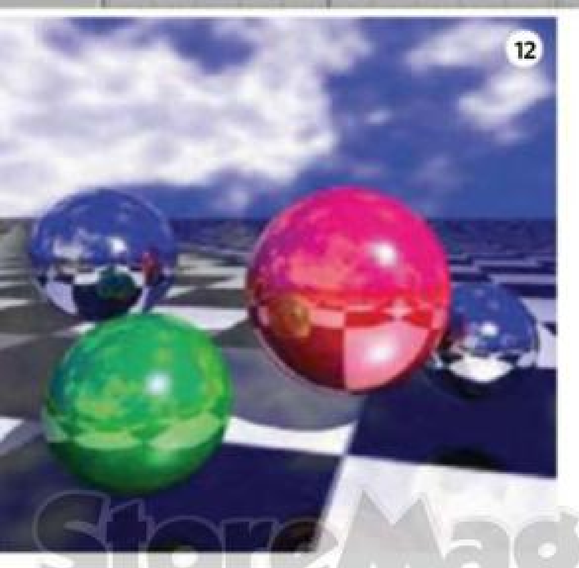
Image by Philip Losch using early CINEMA 4D. Losch still works as one of the most important developers for the software today





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10 Spinning top from The Mechanical Universe (1985) by Jim Blinn, forming part of a 52-part telecourse to teach college level physics. During these productions he developed other standard CG techniques

11 Images by Ron Thornton, an innovative LightWave artist who created the iconic CG in *Babylon 5* using the software

12 "I never understood why in most applications you had to define a light source, a camera and material before rendering... We implemented a different behaviour in CINEMA 4D," explains Losch

> "I THOUGHT OF BUMP-MAPPING WHILE LOOKING AT MY SHOES. I THOUGHT WHAT MAKES THEM LOOK BUMPY IS NOT THE HEIGHT OF THE DISPLACEMENT BUT THAT THE ANGLE OF THE SURFACE CHANGES FROM ONE PLACE TO THE NEXT"
>
> **JIM BLINN,** computer graphics pioneer

LIGHTWAVE

When Tim Jenison founded NewTek in 1985, he too aimed to develop sophisticated yet affordable tools that everyone could use. In 1990 the company first began to enjoy widespread fame with its release of the Video Toaster for the Commodore Amiga personal computer, which also incorporated the first version of LightWave 3D. Replacing video-processing software that had previously cost around $100,000 for less than a tenth of the price, today Jenison is still considered the visionary force behind the desktop video revolution that followed.

Despite the success, NewTek ran into problems after the failure of the Commodore Computer Company and the Amiga computer, subsequently affecting the Video Toaster. "This caused NewTek to port LightWave to Windows and Mac computers as a standalone product not associated with the Video Toaster," explains president of the LightWave 3D Group, Rob Powers.

NewTek survived the challenge and the standalone version of LightWave has since enjoyed worldwide success. "The founder Tim Jenison is one of those unique genius personalities that easily inspires others," effuses Powers. "While I was in school, *Babylon 5* premiered on television and it showcased all of this amazing new computer-generated imagery made with the LightWave 3D software. The genius behind those cutting-edge images was Ron Thornton, who subsequently released video tutorials that were excellent learning tools. They helped me build my LightWave 3D skill set, which made it very easy to get work in Hollywood at that time, because computer-generated graphics were essentially in their infancy. It was a golden opportunity for a student fresh out of film school."

FASTRAY & CINEMA 4D

"In 1988, when I was 13 years old, my parents bought an Amiga computer and I was instantly fascinated by its graphics capabilities," begins Philip Losch. "Shortly after this, my brother and I decided to write our own raytracing software." Aiming to convince MAXON Computer of their newly written software's potential, the brothers entered it into a monthly contest run by MAXON's *Kickstart* magazine and promptly won the competition. Little did they know, they had just developed the very beginnings of what would become CINEMA 4D.

The Losch brothers were hired as developers and, in 1991, FastRay was born. "To be honest, I would say FastRay was just

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1990's

1990 NewTek Video Toaster, for the Commodore Amiga computer, is launched

1990 3D Studio released by the Yost Group only two years after the group was founded

1991 FastRay developed by brothers Christian and Philip Losch

1994 DreamWorks SKG founded by Steven Spielberg, Jeffrey Katzenberg and David Geffen

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14

13 The *Utah Teapot* is one of a handful of iconic models from the early development of 3D computer graphics, having been developed by Martin Newell and modified by his co-worker, Jim Blinn, in 1975

14 Image created by Philip Losch using early CINEMA 4D. When he was just 13 years old, he and brother Christian Losch wrote their own raytracing software – the earliest predecessor to CINEMA 4D

a big learning exercise!" says Losch. "Everything we did was self-taught and at the time it was very hard to come by any real information. We often went to the library and ordered books or scientific papers that then would arrive weeks later." He explains the developers faced significant challenges at the start – not least because though they had entered a very new industry, by the early 90s many competitors had already existed for five or even ten years.

However, as the team began to get increased access to literature and several examples of the competing software itself, Losch realised there were several crucial ways their software could stand out. "20 years ago I never understood why in most applications you had to define a light source, a camera and material before rendering. If you left out any of those steps, your render would show up pitch black," he explains. "So we implemented a different behaviour in CINEMA 4D." MAXON's new software became focused on avoiding the same difficult UI and many illogical steps required to do even basic tasks in other software, making 3D more accessible, inexpensive and as fun to use as possible. "Pretty much every time you need to consult the manual, it's a failure on our side, because we didn't design an interface or component obvious or intuitive enough," Losch reveals.

As the years passed and other competitors began to fail, he tells us it was a matter of persistence coupled with a committed team and healthy working environment that led to CINEMA 4D being a success today. "Most developers that started to work for us five, ten or even 15 years ago are still on board," continues Losch, who is himself still one of the most important developers at MAXON. "Everyone on our team works from home in a relaxed atmosphere and loves 3D – it's not just a normal job."

BEHIND THE PIXELS

As exciting as it can be to theorise on what's next for CG, it's important to remember the past – to think on the people that brought us to where we are today. "The people that have made this industry – they're just the smartest, the most creative and the most friendly, it's so humbling," praises Masson.

It's interesting to consider that, despite his years of research on the history of the computer graphics industry for his *CG:101* books, when Mike Wahrman, a friend who used to work at Wavefront, asked Masson whether he knew who first wrote the standard OBJ file format, he had no idea. Together, they had asked everybody who had worked with Masson in the 80s and, despite how widely used OBJ is today, nobody could remember.

"Just about everybody who started this industry in the 60s and 70s is still alive and active, but it's getting to the age now that we're starting to lose some of our founding members. They're just going to start to pass away and even before they do, memories go as well; like the OBJ file – somebody made an OBJ file but nobody knows who it is," Masson continues. "It would be a tragedy to have some of these folks pass away with these histories in their head... I'm interested in the people behind the pixels. I want the stories of how all this happened."

Interviewing Jim Blinn

Computer graphics legend Jim Blinn (see **www.jimblinn.com/publications** for his work) discusses what led him to take an interest in 3D art, as well as his research into the Blinn-Phong shading model.

When did you first gain interest in CGI and 3D imagery?
I first took the introductory programming course in spring 1967 while an undergraduate at the University of Michigan... Somehow during this time I saw a picture of a graphics terminal and knew right away that was what I wanted to play with.

While there was no official major called Computer Science at the UofM there were several programming courses in the Science department and in the Engineering School. I tried to sign up for all the ones I could. I finally declared a double major in Physics and in Communications Science – a sort of precursor to what later became the Computer Science department.

The computer I used at UofM was expensive and there were only a few of them in the world. I did a few line-drawing animation projects with students in the Art School but never really dreamed that the computers would get so cheap so fast that artists would have their own dedicated machine.

Can you tell us more about your time at the University of Utah? What led you to first begin research on realistic rendering?
I was first made aware of the UofU when my office mate at Michigan showed me the PhD thesis of Utah student Gordon Romney (in 1970) that had some early crudely shaded images. I was fascinated by the images but the computers I had a UofM were not capable of displaying shaded images. I continued to play with line drawing for several years, but in 1974 I decided to apply to UofU graduate school to join the crew making images there. I had kept up with the developments at UofU during the intervening years and was particularly intrigued by the work of Ed Catmull.

When I got to UofU I was surprised to find that they didn't have computers that could display shaded images either. All their images were created by doing a time exposure of the computer display slowly scanning out the results of their computations. I got there just as they were getting the first frame buffer from Evans & Sutherland Computer Corporation, which could display a shaded image on a TV monitor.

I started implementing Catmull's rendering algorithm and began tinkering with it. I didn't have a long-term goal, but just began tweaking various lighting and shading algorithms to make the images look better. I guess that's symptomatic of my career – I just did what seemed interesting at the time and wound up being involved in some of the most interesting projects.

What first led you to create realistic specular light models, bump mapping and environment/reflection-mapping?
Environment mapping began as Martin Newell's idea. We were teaching the Computer Graphics course at Utah at the time. He was a professor there and I was a teaching fellow, and we spent a lot of time taking about rendering and geometry in preparing for the lectures. I think we taught each other more than we ever taught the students. He came in one day and told me he had been thinking in the shower and said, 'What if were to take the calculation for the lighting and, instead of doing the regular dot product with the light source that would give you the colour of the surface, what if you took the light and reflected it backwards?'

I first thought of Bump-mapping while looking at my shoes. They were made of leather but they had this embossed pattern in the surface, and I was looking at the highlights on them and thought what is making these things look bumpy is not the height of the displacement but that the angle of the surface changes from one place to the next. I realised I could nudge the surface normal from one place to the next, plug that into the lighting equation and that would be a good approximation of a more realistic effect.

Did you expect 3D imagery and software to be able to reach the heights they are at now in so relatively short a time?
I've never used any commercial software, only seen it from a distance. I come from an era where everybody did his or her own programming. Having off-the-shelf software that's reliable enough for non-programmers to use is an impressive feat. CG has already gone way beyond anything I could have dreamed of. There are two aspects to visual creative art: figuring out what to draw and figuring out how to draw it. The second of these is what a lot of people think about and teach, but the 'what to draw' part is more personal and subjective.

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ANIMATING THE SONY WAY

CLOUDY WITH A CHANCE OF MEATBALLS 2

The steaks are higher, and this time they can talk. Here the Sony Pictures Animation team reveals how they brought tacodlies, shrimpanzees and cheespiders to life

Pete Nash
Company Sony Pictures Imageworks, LA
Key projects *A Bug's Life, Finding Nemo, Monsters Inc, Toy Story 2, Surf's Up, Cloudy with a Chance of Meatballs*

Pete Travers
Company Sony Pictures Imageworks, LA
Key projects *What Dreams May Come, The Lord of the Rings: The Two Towers, Harry Potter and the Philosopher's Stone*

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The foodimals were the product of many brainstorming sessions – as well as some creative kitchen sculptures carved up by the directors!

***Cloudy with a Chance of Meatballs* wasn't your usual, straightforward animation.** First there was the story – a super-silly yarn in which inventor Flint Lockwood accidentally causes giant food to rain down on the unfortunate Swallow Falls following the invention of the Flint Lockwood Diatonic Super Mutating Dynamic Food Replicator.

But even more interesting was the unique approach Sony Pictures Animation took with the look and movement of the world itself. Much like the Genndy Tartakovsky-directed *Hotel Transylvania*, which Sony Pictures Animation put out last year, 2009's *Cloudy* was a dynamic, energetic and elastic affair. Its characters snapped and spun around the screen in a flurry of animated moves that looked more in line with wacky Saturday-morning cartoons than the fluid animations seen in today's CG adventures.

Now, in *Cloudy with a Chance of Meatballs 2*, that fun-loving approach to animation has been turned up to 11... and then some. It's been three years since Lockwood caused the Swallow Falls foodpocalypse, yet his still-working invention has turned the once suburban township into a verdant island filled with sentient food beasts. From self-aware pickles to shrimpanzees, watermelophants and, of course, Barry the strawberry, Sony has created a whole new world of foodstuffs with which to explore its animating potential. It's a tantalising prospect indeed.

"The overall style from the first film, which we still tried to apply to this film, is kind of like a combination of *The Muppets* and the UPA," says Pete Nash, senior animation supervisor on the film. The UPA was, of course, the United Productions of America – an animation studio founded after the Disney animators' strike of 1941. Lots of long-time Disney animators were unhappy with the ultra-real road Disney was travelling and so the UPA decided to move in a different direction. "The UPA didn't want to get so concerned about accurately moving volumes around in space. It wanted to flatten the image and use the medium in a more abstract and expressive way," continues Nash. "This design-orientated approach resulted in something that was quite conceptual. They were using motion in a very expressive way. It wasn't about doing something that looked realistic – it was about making something that was more of an abstract expression.

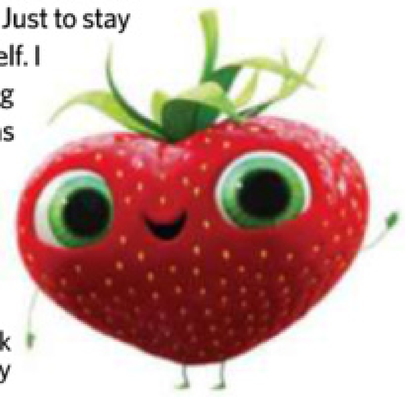
"That was all from a long time ago, so the directors (Cody Cameron and Kris Pearn) asked me to look at the stuff they did, as well as *The Muppets*, and come up with a mixture of the two. You can see from the design of the characters that they are based on *The Muppets*." With a crew of over 100 animators, a tight schedule and many

Best of the bunch

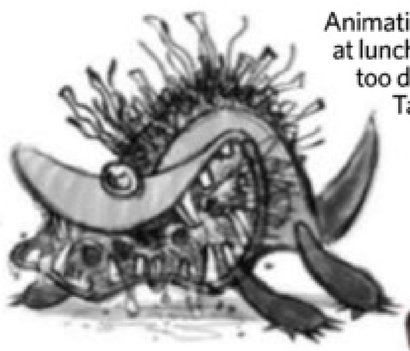
Pete Nash and Pete Travers pick their favourite foodimals

"Barry, because he's one of the more complex characters. The interesting thing about him is that he's kind of the ambassador to this world. Some of the foodimals are just pure animal instinct and then some are a tribe. The berry tribe is definitely one of the more sophisticated. Imagine someone who lives in paradise, or this Utopia, who doesn't understand what struggle is. That's what Barry is. He's pure positive energy." **Pete Nash**

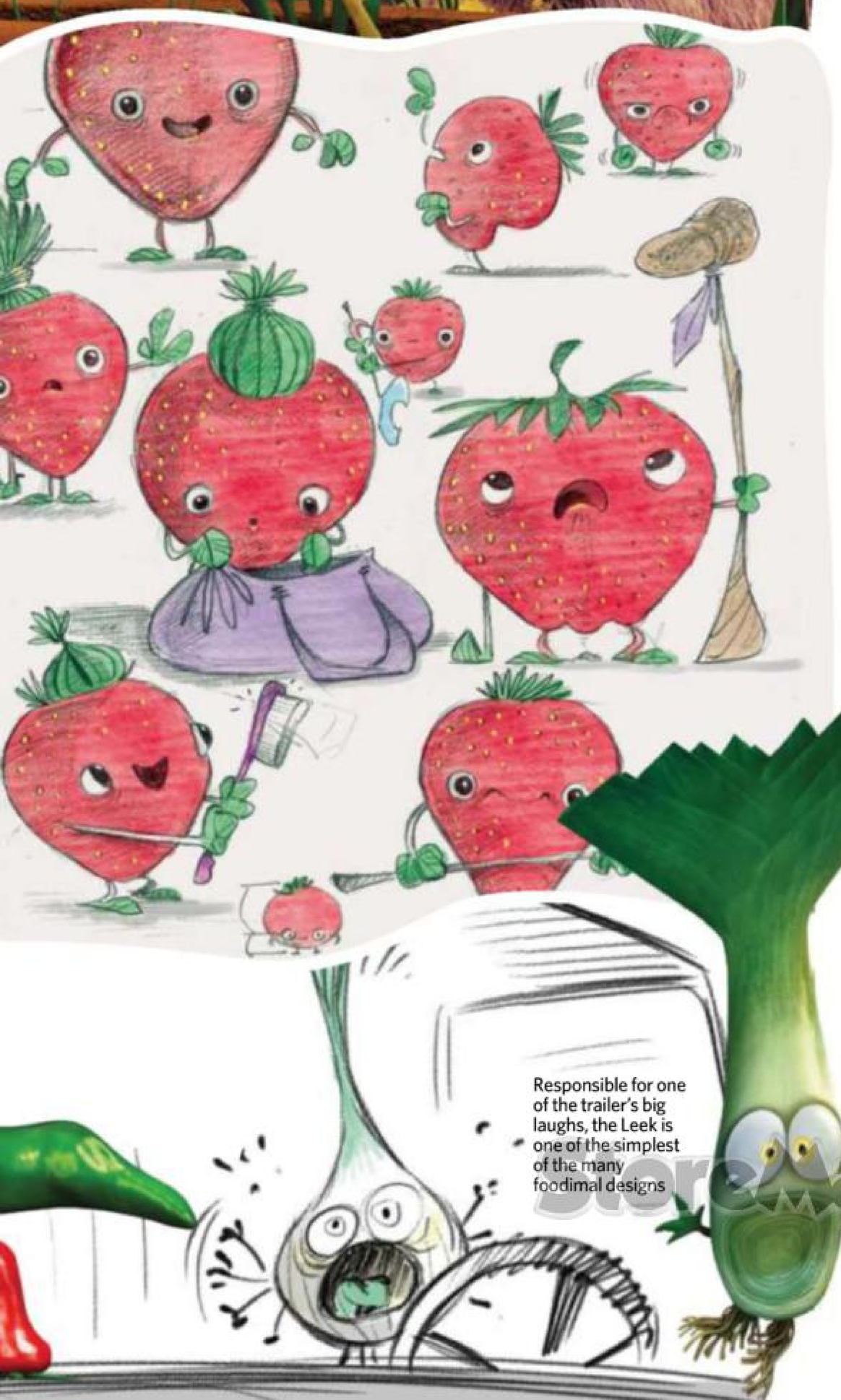
"We may have cornered the market on cute characters, because Barry, the strawberry, is cinema gold. However, I love the Sasquatch character. He was my pet project. Just to stay fresh with tools, I ended up building him myself. I was able to do the modelling and the texturing and rigging, so I could see how everything was working out. As a VFX supervisor you can get a little removed from how things actually work, so it was a real fun opportunity for me to be able to do that." **Pete Travers**



Barry has 5,243 little hairs to make him look like a real, walking, talking strawberry



Animation reviews were banned at lunchtimes, as real food was too distracting if you had a Tacodile to work on



Responsible for one of the trailer's big laughs, the Leek is one of the simplest of the many foodimal designs

last-minute changes going into the ever-evolving story, *Cloudy with a Chance of Meatballs 2* was not the easiest follow-up ever conceived in Hollywood history. However, thanks to the hard work of the dedicated and imaginative Sony Pictures Animation team, the final result is something to be marvelled at. The ambition of the story and the team really is only matched by that of the animation.

ANIMATING WITH STYLE

Matching the snappy animation of the first film and injecting just as much fun into it, if not more, was key in *Cloudy 2*. It was a task the team jumped on with gusto. First, however, came the task of designing the 36 types of foodimals encountered throughout the film.

It all started with director Cody Cameron carving up fruit and vegetables in his own kitchen. The seemingly simplistic look of the creatures belies the incredible level of detail that went into each. Each seed on Barry the sentient strawberry was individually modelled, adding up to 5,243 hairs and 406 seeds. Even the cheespider's 203 eyes had to be individually controlled.

"We put a lot of thought into how the foodimals would move," says Nash. "The thing there, especially with the larger creatures, was that their design is inherently a joke. So how do you make something like that move? In this case, we decided to make their movement as realistic as possible. Just like in a monster movie they have a lot of weight. It almost works against how silly they look."

> "We put a lot of thought into how the foodimals would move... The thing there, especially with the larger creatures, was that their design is inherently a joke
>
> **Pete Nash** senior animation supervisor

In reality, however, it wasn't the animalistic creatures that demanded the most out of the animation teams during production, but rather the human characters. In the *Cloudy 2* world, it was important that each character have their own concept and unique movements to match, with those animations designed to demonstrate who the characters are. "We always try to be very conceptual about it," Nash explains. "A good example is Earl. He's like this super cop who is under-utilised, so he's got a lot of pent-up energy. Every move he makes is like a sprinter exploding out of the blocks. Every time he stops it's like someone slamming on the breaks. That's his concept."

However, the complexities of Earl had nothing on those of new character Chester. One of the biggest challenges on the entire project, Chester is a cross between Richard Branson and Steve Jobs – an innovator, world-leader, CEO type. To demonstrate Chester's faked new-age persona – which is really just a mask for his self-involved personality – Nash and his team chose to make Chester the ultimate showman.

"Chester can isolate parts of his body in any way he sees fit, in order to give the best presentation," says Nash, "To really exaggerate that, we'll have his chest block his face while his legs are still catching up and then his head will make a sudden change in direction and his body will follow, with a whiplash-like action. It's all him doing this performance, so everything he does isn't real, it's faked."

However, these movements were not so easy to achieve. "Chester has tiny sticks for legs and a light bulb for a head, so he'll be moving at perfect right-angles and he won't do a lot of twisting," explains Nash. "He can move through a right-angle corner, as if someone were being forced through a tube with a sharp turn. We had to painstakingly animate that frame by frame. It took a great deal of experimentation to figure out how to make him move."

Fortunately, a method was found to quickly achieve the sporadic and extreme nature of Chester's various movements. "We knew we needed to explore Chester, but at the same time we were worried because we hired a lot of new animators on this movie," remembers Nash. "We were concerned that they may not get it. What we did in the end was kill two birds with one stone. All new animators who came onto the show would spend their first week doing a Chester performance test. I would explain the character to them and many of them would come up with such inventive stuff that we added to the arsenal of Chester. He ended up being a complete success thanks to this high level of exploration."

For Nash, moving away from realism in this way is part and parcel of what makes the animator's job so much fun. "For me, that's where all the fun is," he says. "You're doing a caricature of motion and expression of motion, rather than trying to copy something. For me that's what it's all about."

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Animating the Sony way

Production designer Justin Thompson and the art team spent a day painting to create swatches, brushes and textures that could be used in the backgrounds

Toying with realism

Although many of today's animated features are set in very cartoonish locations, it's often the case that their characters' movements are based in real world physics. For Nash and Travers, however, it's often more fun to animate characters that aren't slaves to realism, allowing them to bend, snap and gyrate in a completely comical manner.

However, this isn't to say that real world movement doesn't inform *Cloudy 2*'s animation to some extent. "I do enjoy working on shows with realistic animation because of the subtlety and the nuance in the performance," begins Nash. "However, if you try to put all those same observations, which we would in a subtle performance, into *Cloudy 2*, it's not going to work. So, we try to do it in a stylised way.

"With the style of animation in *Cloudy 2*, what you want to do is only use the channels of animation that you have to," he continues. "You want to pare down your residual animation. When a person moves around, there's a lot of noise there; a lot of bumps and little details. We carefully choose representations of those, so they're still believable, but we strip a lot of them out. It makes for clean and crisp animation."

While many animations opt for a realistic animation style, *Cloudy 2* strives for a cartoon-like approach, blending UPA with *The Muppets*

BUILDING BACKGROUNDS

Easily one of *Cloudy 2*'s impressive elements is that of the movie's new environments. Gone are the residential stretches of Swallow Falls as it was once known, now replaced by a jungle-like world of grub, packed with an amount of variety, detail and colour rarely witnessed in a Sony Pictures Animation production. For Pete Travers, VFX supervisor on the film, these painterly panoramas easily presented some of the biggest challenges.

"The first movie was more of a disaster story that centred around the town, but in the second movie, because Flint's machine has run amok, there's a whole new ecosystem," explains Travers. "We had to build that entire ecosystem. We wanted to create the feeling that you were travelling through varied environments. Many of these had to be built from the ground-up. There's also a very heavy emphasis on design. We couldn't really procedurally build things – we had to go ahead and explicitly build every element. There was a lot of back-and-forth through modelling and layout and back into modelling. Eventually we'd get it into animation and see how things were working out, then back into layout and then texturing, lighting and putting the shots together. I wouldn't say we were doing anything particularly ground-breaking, but the heavy emphasis on design, relative to the camera, made it a whole bunch of hard labour."

The hand-painted look to the world came originally from Justin Thompson, whose stylised concept art was key to pushing *Cloudy 2* in new artistic directions. "I looked at his artwork and I really loved it," says Travers. "If you're not careful, animated features can start to look photorealistic and I don't think that's where we want to go. Ultimately we're making high-powered cartoons, so we needed to break down what Justin and his team were doing with the impressionist style of the concept art and see if we could somehow translate that into a full CG environment."

However, while working on the unique aesthetic of the film, the team noticed that as objects moved further from the camera they lost the definition created by the lighting. "They turned into something more akin to impressions of texture and colour, rather than a defined object," explains Travers. "The solution was simple shader stuff. We started stripping out lighting and preserving colours. This meant that composition became more of a requirement, because you're no longer balancing the scene with lighting, but balancing things with texture, colour and shape. A lot of the objects would be orientated more towards the camera, rather than just building an environment and storing it in layout.

"I want to stress that this is not a technological advancement, because what it really did was just force artists to really be artists and think about the composition, and it worked," continues Travers. "In the first act of the film, in San Fran Jose, we were using the traditional *Cloudy 1* rendering look, but when we get to the island and see these more dramatic, fantastical worlds, we start to get a little more impressionistic. You can see that in the backgrounds. The great thing about stripping out the lighting as an object moves further away from the camera – which we did in a smooth, linear fashion – is that it becomes very smoothly blended. This came to the point where we could drop a matte painting in at the very back and it wouldn't break the look."

The result is a bold, impressionistic style, perfect for the movie's many establishing shots. "A lot of the artwork that's in there – like the first reveal of the characters looking at the lagoon – is extremely impressionistic. You would be very hard-pressed to find where the CG starts and the matte painting ends. You feel like it's all one big world and you know, for me, that's what these movies should be about. They should be impressionistic. They should be fantastical. The subject matter of the movie really lends itself to that."

SOFTWARE SELECTION

Sony Pictures Animation uses a Maya pipeline and the approach was no different on *Cloudy 2*. "Our layout is in Maya and all of our modelling is in Maya – of course we have ZBrush plugged in there too," says Travers. "Texture painting is done in MARI and all of our animation is done in Maya, heavily surrounded by plug-ins and scripts.

"The nice thing we've got now is our primary renderer, Arnold," continues Travers. "At this point it's pretty much our sole renderer. In the early 2000s we'd spend a lot of our time trying to make everything look integrated, because our illumination models would be in different renderers and the compositor's true task was trying to integrate these disparate elements. Nowadays, however, everything goes into Arnold. The light just bounces off everything and makes things look really pretty in ways that would be hard to direct. I'd rather have a renderer take care of things than say, 'hey, I want this shadow to be a little softer,' and so on. This way you get a lot of good stuff right out of the gate and it's just as polished."

Nash, meanwhile, highlights Sony Pictures Animation's Tweak Tool. "Without

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> You would be very hard-pressed to find where the CG starts and the matte painting ends. This is where it's at its most successful. You feel like it's all one big world and you know, for me, that's what these movies should be about
>
> **Pete Travers** VFX supervisor

The Sony team were determined that the crowds in *Cloudy 2* were going to be as dynamic as possible, maintaining a level of realism and believability for the audience

> "I've studied how a real crowd behaves and there is a lot of what's called micro chaos... We wanted to match that diversity in our crowd"
>
> **Pete Travers** VFX supervisor

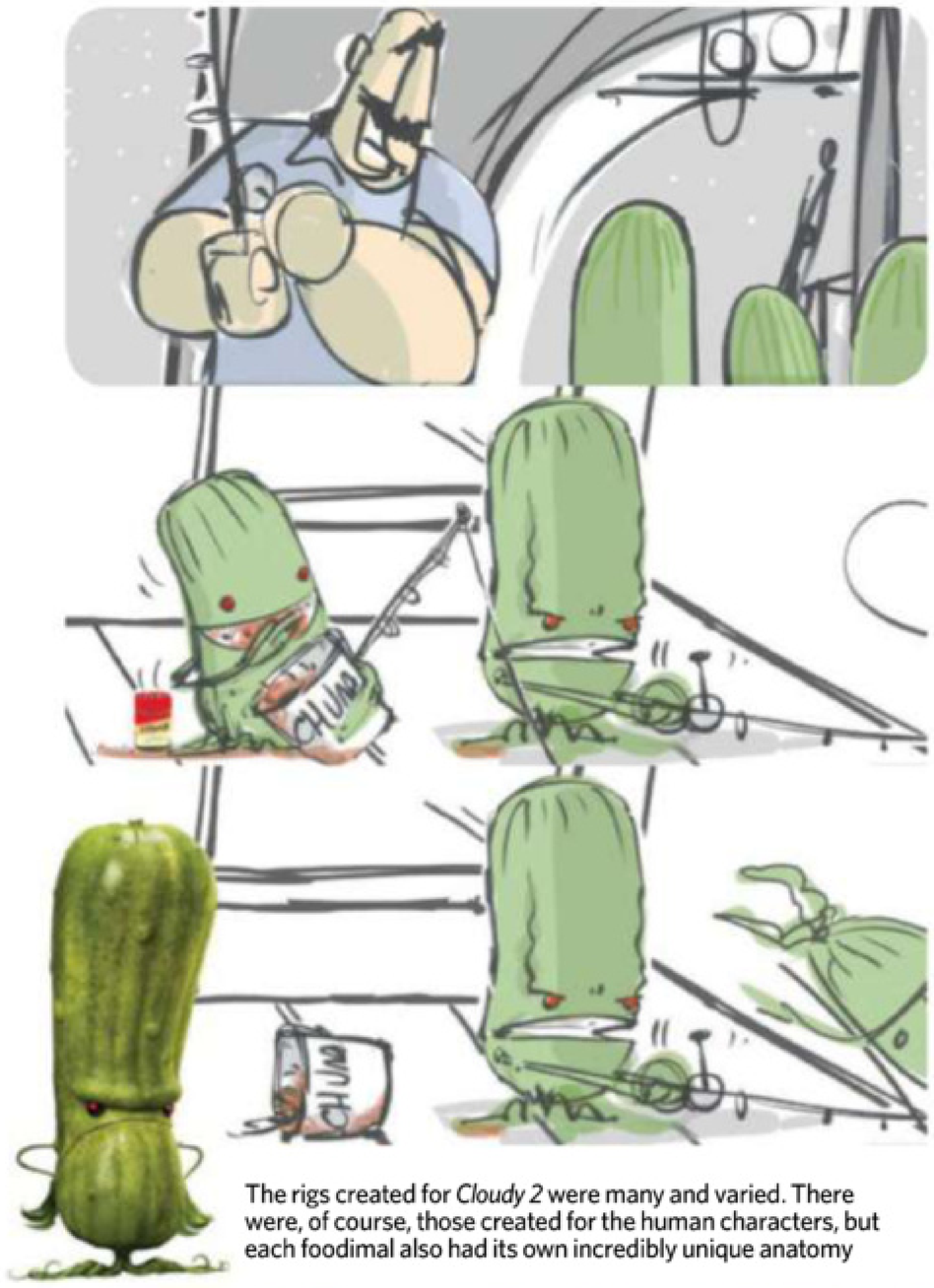
giving away too many company secrets, the Tweak Tool gives us the ability to manipulate geometry, model and rig on-the-fly in a shot," he explains. "So, if you have the character, you can create a new shape, or if there's geometry that's not rigged that needs to move, then you can create a reasonable rig inside the shot. The other thing it does is give us the ability to force the character into a silhouette that works for the camera. This means you're working on stylised shapes almost in 2D, but with the result in 3D."

Another of the challenges directors Cody Cameron and Kris Pearn set their team was to raise the bar in terms of crowd animation. Rather than using simulation tools such as Massive, as they had in the past, the Animation department took complete control, with their aim being to make the crowds look fully believable. "The directors completely agreed with me that oftentimes in movies, they would think the background crowds would seem exactly what they were: half-assed attempts to create diversity," explains Travers. "It ends up being one character repeated, but half of them are wearing hats and the other half a red sweater. It doesn't look like a true crowd. I've studied how a real crowd behaves and there is a lot of what's called micro chaos – there might be a lot of seats that are empty, or people walking up and down stairs, or people with their feet up on the chair in front. Conversation is going on. Interaction is going on. We wanted to match that diversity in our crowd."

Sony Pictures Animation came up with a very character-orientated system to solve this problem in one scene, where Chester gives a presentation to an audience of hundreds of thousands. The team spent a great deal of resources creating a variety of character designs, each very different from the last in terms of body shape and general appearance. The system could then create a brand-new character by blending various elements of these characters into one another, creating entirely new individuals. The end result was an incredible amount of crowd diversity.

"We had millions of characters," says Nash. "For the coliseum scene we got the Pipeline department to help us procedurally place each of those characters in the scene. All of the animation cycles were created by our Animation department and there were a great deal of them completed. I think what we achieved was very rich and believable."

Cloudy 2 might be a fantastical comedy set in a world where food has come to life and populated with characters seemingly made from rubber and elastic, but the experience is nevertheless immersive, engrossing and beautiful. Rich with imagination and humour, this is one animated movie not to be missed by any CG die-hards or fans. *Cloudy With a Chance of Meatballs 2* is out now.



The rigs created for *Cloudy 2* were many and varied. There were, of course, those created for the human characters, but each foodimal also had its own incredibly unique anatomy

The importance of rigs

Pete Nash discusses the creation of flexible animation rigs

When working on an animated project as diverse and packed with action as *Cloudy with a Chance of Meatballs 2*, carefully constructed animation rigs are key. "We needed extremely good rigs for this project," states Nash. "They're really flexible and that's critical. For example, on Flint you can get his mouth so small it's little more than a dot – just like you'd see in a cartoon strip. However, we also have the ability to bring the smile up right behind his eyes and open his head like a Muppet. It's hugely flexible and really adds to the comical final look to the film."

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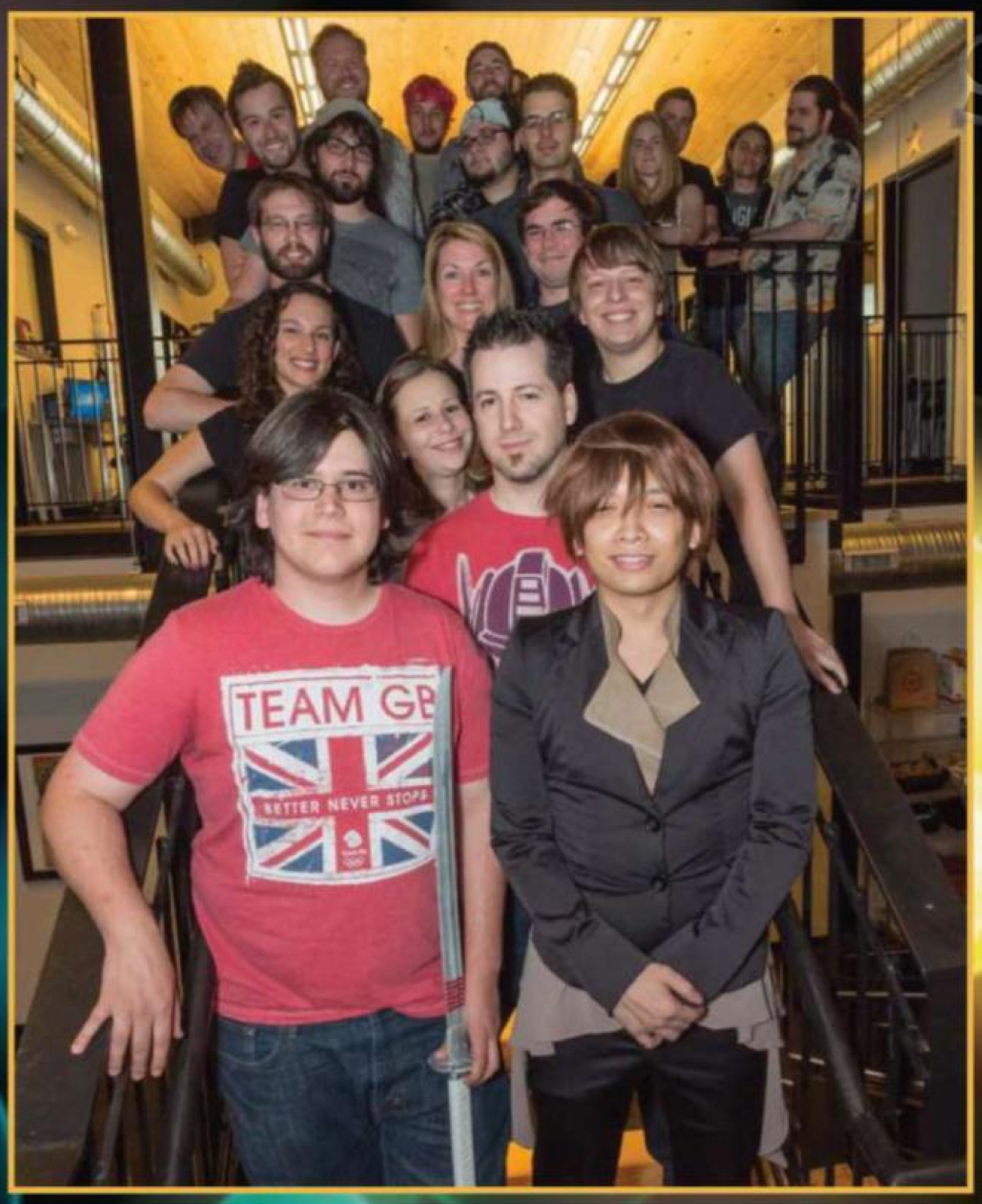

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Inside UNREAL ENGINE 4

Epic Games is celebrated for franchises like Gears of War and Unreal Tournament, but it has also gained world renown for the development tools found in its Unreal Engine. We sat down with Epic to discuss where the studio is taking these tools next with the impressive Unreal Engine 4

Think of a game as being similar to a modern car," 3D Artist is told by Epic Games' senior technical artist Alan Willard. "Any car on the road needs certain key components, otherwise, it's not going to go very far. Chassis, motor, transmission, battery, wheels, steering and more all need to be present and working together or the car just doesn't work. In a similar way, games require a set of systems to function."

It's a pertinent analogy – after all, under the hood of every videogame is an engine powering the spectacle; rendering graphics to screen, reading inputs from players and enabling physics that facilitate spectacular interactions such as collapsing buildings and flying cities. Over the past 18 years Epic Games has been refining its Unreal Engine as a framework and toolset to be used by developers when realising such visions.

Epic first began working on the Unreal Engine in the mid-90s, for a game aptly titled *Unreal*, and the engine was quickly heralded not only for its graphical capabilities but also its user-friendly development tools and ease of use. Garnering the attention of external studios, Epic took the decision to begin licensing its development tools for other artists to utilise.

"To go back to the car analogy, imagine being told to build a car and you're given a few choices," continues Willard. "One: you can try to build all the pieces yourself, which means you might end up with something completely unique, but it's going to be a long time before your first test drive. Two: you can try to buy the different parts from different vendors, but you'll end up doing a lot of work to get everything working smoothly together. Again, you're not going to be driving your car any time soon. Or three: you can choose to start out with a fully functional car and choose the pieces on which you want to spend the time to customise. It will begin as out-of-the-box, but now your time and attention are building something unique on top of a full, tested and working platform. You're up and driving almost immediately, so instead of figuring out how a transmission works, you're customising your experience, replacing parts as needed to get the exact end result you want and you've done it in much less time."

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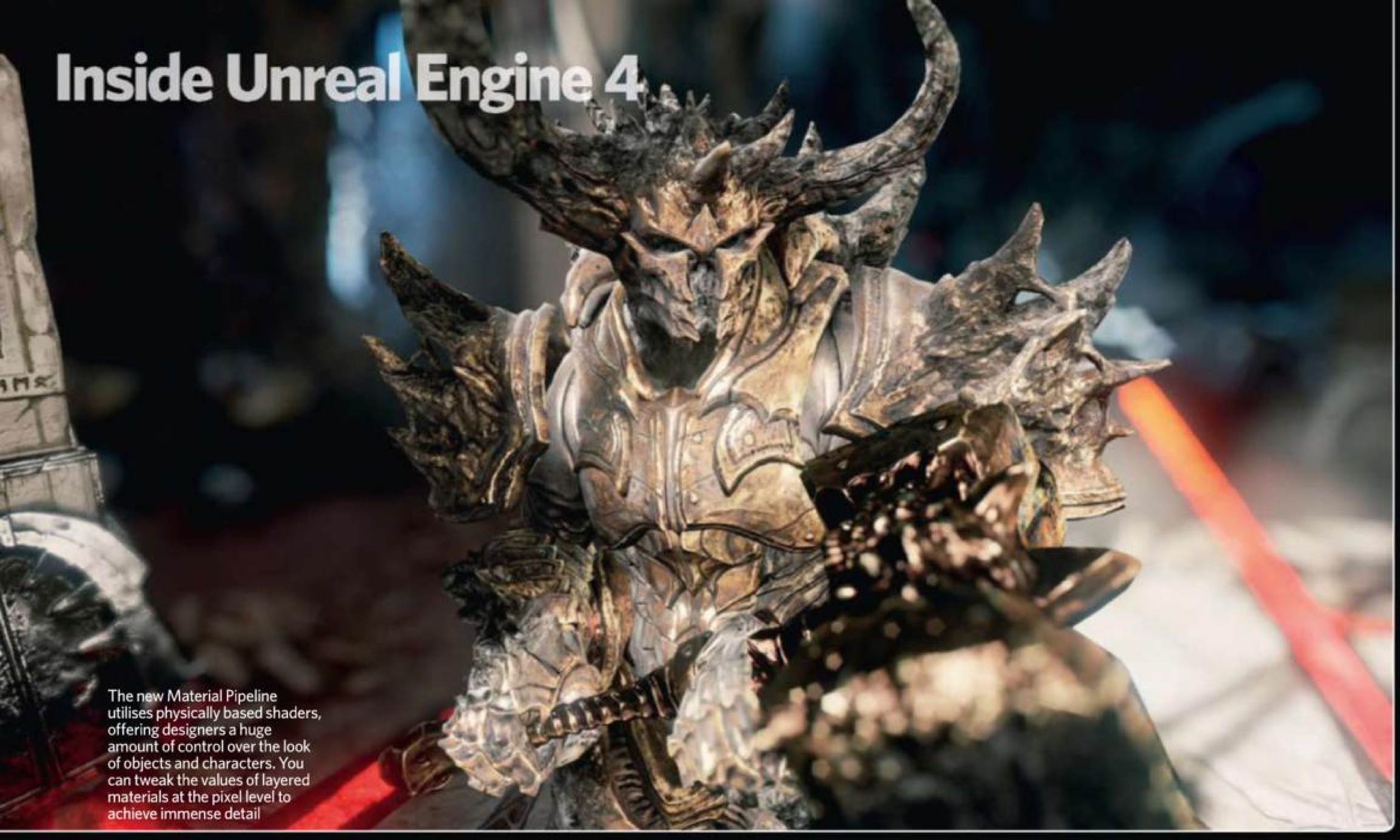
Inside Unreal Engine 4



The new Material Pipeline utilises physically based shaders, offering designers a huge amount of control over the look of objects and characters. You can tweak the values of layered materials at the pixel level to achieve immense detail

Game spotlight: Fable Legends

One of the highest-profile next-gen games to utilise Unreal Engine 4, *Fable Legends* is the latest sequel in the immensely popular Xbox franchise developed by Lionhead Studios. Here two of the development team talk about the advantages of creating the studio's eagerly anticipated sequel using Epic's latest engine.

"An important consideration for us has been dynamic lighting," says Ben Woodhouse, lead engine programmer on *Fable Legends*. "Unreal Engine 4 has a really nice deferred renderer with support for physically based materials and many light types. Our rendering team have extended that, adding a dynamic GI solution that provides real-time diffuse and specular bounce lighting. This ensures consistent high-quality lighting across everything in our world, including dynamic objects. As a secondary benefit, iteration times are now near-instantaneous and overnight lighting builds are a thing of the past."

Art director Kelvin Tuite adds that the studio has been aiming for a level of visual fidelity that far surpasses anything currently in the medium; something more akin to the detail and quality of a Pixar film. "The combination of the Unreal Engine 4 on Xbox One and the genius mods of our engine programmers not only enable us to hit this fidelity, but hit it in real-time," he tells us. "The WYSIWYG flexibility of the Unreal editor enables us to rapidly prototype the look and feel of game levels. We can dynamically rearrange a fully lit and textured level without the need for rebuilding or rebaking and then the artists can experiment with the overall look, balancing and tweaking the interaction of the lighting, materials, shaders, particle effects and post-processing, all with instant feedback."

DRIVING DESIGN

Gears of War, *BioShock*, *Batman: Arkham Asylum* and *Mass Effect* are just a few of the hugely successful franchises that have used the Unreal Engine in the years since its inception. The third iteration alone, Unreal Engine 3, has powered over 200 games developed from a myriad of studios based across the world. As with any success story in the games industry, a sequel inevitably follows. Over the last couple of years Epic has rolled out Unreal Engine 4, which has already been adopted by studios worldwide, specifically to develop games for next-generation console hardware. The improvements UE4 offers in-game visuals is vast. Another of Epic's senior technical artists, Jordan Walker, guides us through some of the specific advances in the engine: "We now have consistent reflections across all surfaces, so material types that are mostly reflection – like metals, for example – look much better than before. Unreal Engine 4 material shading is physically based, which means all surfaces have accurate specular with Fresnel and are energy-conserving. We now also have GPU particle simulation with collision, which is useful for creating systems with millions of particles that react and bounce off the world around them. Since we use tiled deferred rendering we are also able to render scenes with thousands of dynamic lights.

"Our post-processing has also been overhauled to enable many new lens effects, one of which is dynamic lens flares. This feature creates lens flares based on any bright content rendered, meaning the artist doesn't have to create a flare for every bright asset – instead the renderer reacts like a true camera lens."

The fact is that the new features list for Unreal Engine 4 is almost as long as the exhaustive feature list of its current-generation toolset, implementing a range of new rendering techniques, such as full-scene HDR reflection, temporal anti-aliasing and new configurable post-process features. However, one of the most exciting developments is Blueprints, a new visual scripting system that enables artists to realise concepts at the game, or individual object level.

"Blueprints enables developers to build objects that display whatever exact behaviour they can imagine," explains Willard. "For example, if a designer wanted to build a streetlight, before Blueprints they'd have a streetlight mesh that they'd place in the world, then they'd add a light, maybe a sound for the electrical buzzing and a particle system for dust and insects flying through the light. If they were to do this inside of a Blueprint, they could add all these things as part of the core Blueprint and then really get in and define custom behaviour. For example, you can add a checkbox for whether the light is on and that can drive if the bugs are present, or turn on or off the buzzing sounds, or decide if the player drives a car into it whether it breaks (and if it's off, do we still have electrical sparks?). All of these behaviours can easily be created by a designer or artist inside the Blueprint system and they can debug this all in real-time, actually watching the behaviours execute while playing the game. These kinds of tools make it much easier than ever before to

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"It's much easier and quicker to get a high-quality result in Unreal Engine 4"
Jordan Walker, senior technical artist, Epic Games

create unique, powerful game content that can easily be extended down the road as the design evolves for your project."

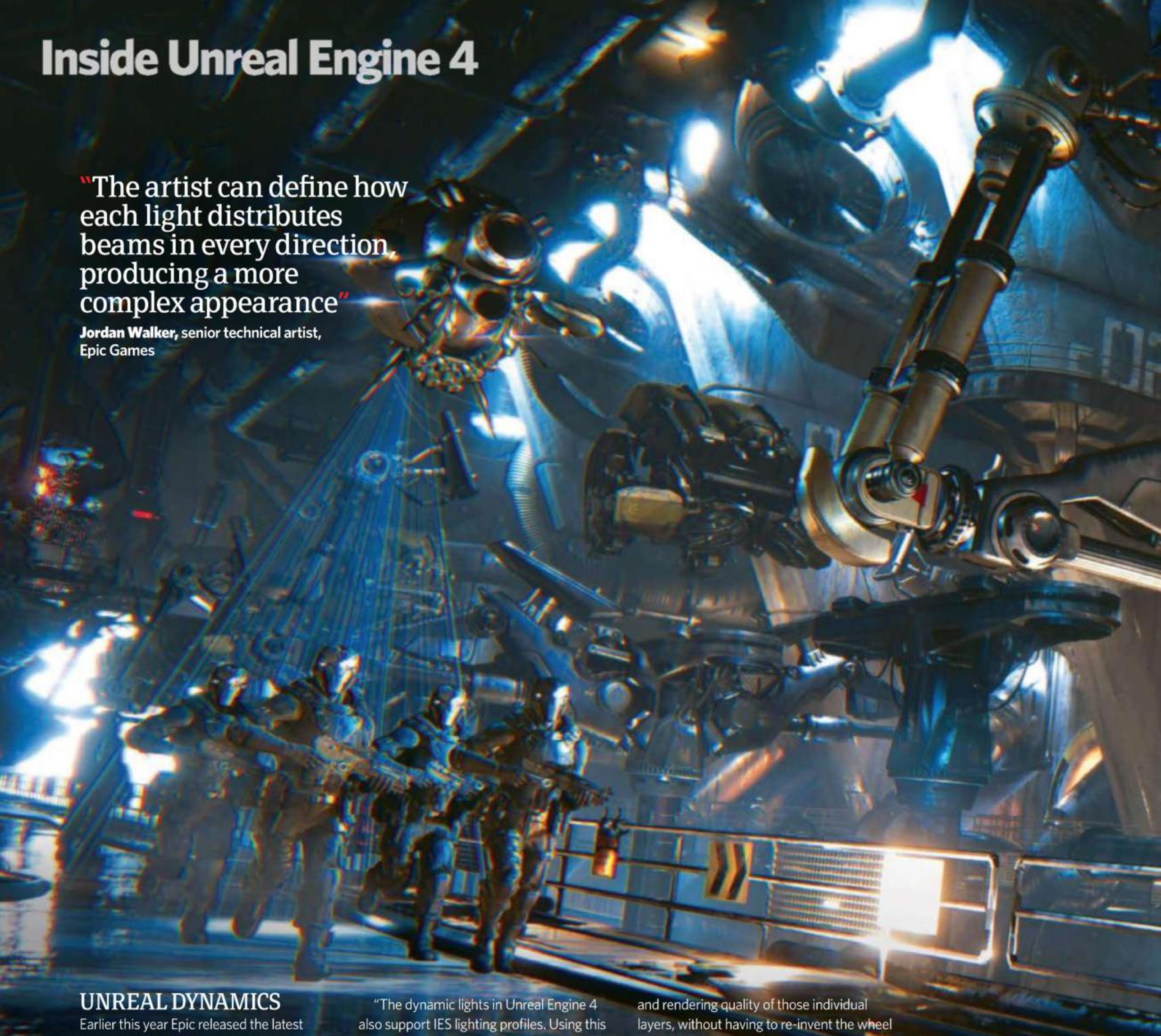
Along with the many other enhancements in the engine's debugging tools, GPU particles, an advanced asset browser and more, the unmatched level of freedom that Unreal Engine 4 affords artists is clear. "It's much easier and quicker to get a high-quality result in Unreal Engine 4," Walker continues. "Artists can easily import their assets, create a physically based material, put it in a scene with image-based lighting and have something that looks very good very quickly. Additionally, the support for material layers means that the workload for making a set of assets or a game will go down drastically, since so much work is reused."

Indeed, Unreal Engine 4's new Materials pipeline helps artists maintain fidelity across a range of environments, taking advantage of node-based visual scripting. This is one of the ways the engine speeds up the process drastically as, again, Unreal Engine 4 enables changes to be implemented in real-time across the entire game, making for an infinitely more flexible workflow.

"The new advancements actually make it easier for artists to create accurate materials and share content, because physically based materials react correctly in all lighting conditions. In the past, an artist could create a material that looked good but maybe was tweaked unrealistically for one lighting scenario, so when the asset was placed in another lighting condition it would fall apart. However, since the concept of material layers is based around layering tiling materials using unique masks, artists don't have to paint really high-resolution custom textures for every material attribute on an asset. The artist is able to tackle each layer individually so he or she can focus on making any surface as high-quality and accurate as possible. They can focus on the asset at a higher level without having to worry about the accuracy of the specular value, or the surface's roughness," adds Walker.

The first Unreal Engine 4 demo released by Epic, 'Elemental', focused on lighting, particle effects and detail running on PC. Recently the studio has released the same demo running on PlayStation 4 hardware to give some insight into how the engine will fuel next-gen experiences

Inside Unreal Engine 4



> "The artist can define how each light distributes beams in every direction, producing a more complex appearance"
>
> **Jordan Walker,** senior technical artist, Epic Games

UNREAL DYNAMICS

Earlier this year Epic released the latest demonstration of the capabilities of Unreal Engine 4 in its short film 'Infiltrator' (**tinyurl.com/3DAInfiltrator**). Set against a backdrop of a sci-fi industrial facility that could've been lifted straight from *Blade Runner*, it showcases the materials, rendering and lighting power of the new engine running in real-time with Epic's patented bombast.

While employing many of the features mentioned above, Walker specifically highlights the impressive dynamic lighting facilitated by Unreal Engine 4: "The engine uses a tiled deferred renderer, so it can render thousands of lights at once on the screen. Artists are also able to spawn these lights in particle systems, meaning creating effects like explosions, sparks and muzzle flashes is much easier than ever before. All of these lights affect the lighting of the world around them.

"The dynamic lights in Unreal Engine 4 also support IES lighting profiles. Using this feature, the artist can define how each light distributes beams in every direction, producing a more complex appearance. The engine also supports image-based lighting, enabling imported HDR images to provide the ambient lighting for scenes."

Alan Willard goes on to explain the importance of the engine's new physically based shading model and the impact it has on in-game lighting: "Physically based shading means a surface will respond to light in the same way it would in the real world. This means building content that looks realistic, or responds to light in a realistic way, is much faster and easier than before. This combined with our Material pipeline system means we can create multiple basic surfaces like rock, steel, ice, water, flesh and so on, then combine them in a final material that inherits the properties and rendering quality of those individual layers, without having to re-invent the wheel every time."

While all these advancements will eclipse techniques used in older builds of the engine, traditional concepts will still be found within the new toolset. For example, the character creation process remains unchanged aside from support for material layers, with artists still using established methods of painting textures when a character requires minute detail. Still, for the most part, Unreal Engine 4 will have a big effect on the pipeline.

"It has already had a huge impact on speed and flexibility for us as well as our licensees," says Willard. "The ability to iterate on design and content rapidly is what enabled us to produce the 'Infiltrator' cinematic in a matter of months. Blueprints give designers the ability to easily build, iterate and test their creations – the rest of our tools reflect that ideology."

3dartistmag.com

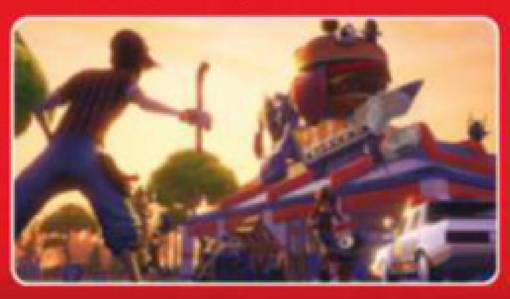
Running in real-time, the 'Infiltrator' demo impressively showcases Unreal Engine 4's high-end rendering features, while also demonstrating other notable features such as the excellent real-time lighting

Other games to utilise the Unreal Engine over the years include *Borderlands*, *Splinter Cell* and *Mortal Kombat*. "Many titles using our technology continue to be genre-defining," says Alan Willard

Unreal Engine 4: The games

DAYLIGHT A first-person survival horror game with a difference, *Daylight* casts players as a woman who uses the light on her mobile phone to navigate through the zombie-infested corridors of the hospital she wakes up in. With lighting playing such a key role in the title, it'll put the full extent of Unreal Engine 4's advanced lighting systems to the test.

FORTNITE Epic's first major release using Unreal Engine 4, *Fortnite* highlights how the engine can be used to create immaculately conceived fantastical worlds with acute attention to detail. This cartoony action game involves players scrambling resources by day to fortify their defences from the zombies that invade during the night.



PRIMAL CARNAGE: GENESIS In a story similar to *Jurassic Park*, prehistoric creatures have been brought back to life on a remote island and the player has to survive once the wildlife escapes. Showcasing UE4's depth and detail when it comes to character modelling, *Primal Carnage* offers a taste of how fantastical creatures can be brought to life.

RIME One of the smaller-scale projects currently in development using Unreal Engine 4, this is a whimsical adventure title that uses light and shadow as tools for players to progress through the story. Its minimalist and cartoon aesthetic, reminiscent of *Zelda: The Wind Waker*, reflects the visual diversity and scalable nature of Epic's engine.

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Character aesthetics in Unreal Engine 4

A character demonstrating multiple surfaces – metal buckles, Kevlar fabric and plastic features. The first step in its creation is much the same as it was in previous iterations of the engine. A character artist first creates a high-polygon model and hands that off to the texture artist. (1)

The texture artist creates a few different textures, one being a material mask that colour codes where each different type of surface is placed on the character. The different types of metal, plastic and other features are represented by the distinctive colours you can see here. (2)

The artist then creates an asset, which is a texture that represents where cracks, grime and dirt collect on the surface. The final asset shows scratches and scuff marks, where the surface may rub against other objects. (3)

The final image utilises the high-resolution tiling material with multiple layers to create a massively detailed character model with distinctive surface types. (4)

THE EPIC FUTURE

Rather than teams growing in size, Unreal Engine 4 will increase productivity by giving more power to the individual artists on the front lines. "As the tools and capabilities of the engine advance, our focus is always to improve the efficiency of anyone using our tools. Making artists, designers, engineers, or anyone else involved with the engine as productive as possible is why we're continually improving our tools," says Walker, once again pointing to Blueprints as a high watermark for UE4's power.

"A good example of this is real-time debugging for Blueprints. Watching the flow of your Blueprint execute while you're playing is an improvement in our workflow, as designers can make the right changes and fixes while they're still working on the content. Being able to share base materials to be used in countless layers across one or multiple projects is also a huge time-saver."

This will, by all accounts, improve the relationship between artists and coders. "UE4 is designed to streamline the cross-discipline relationship on multiple fronts," explains Willard. "Artists and designers are constantly trying to come up with new ideas for design and gameplay and the code teams are trying to satisfy those needs while fleshing out systems, building new features and so on. Being able to leverage these systems inside of Blueprints means that a lot of behavioural interaction that previously had to be implemented in the gameplay code can now be managed by the designers themselves!"

It won't be long before gamers are given an opportunity to see Epic's work put into practise. The first batch of titles running on Unreal Engine 4 are due to hit PlayStation 4, Xbox One and PC in 2014 and naturally Epic has been busy crafting its own game to demonstrate the capabilities of its latest engine. "We're excited about *Fortnite*, because we're so close to it every day," says Walker about the studio's in-house zombie-basher. "It's the next big thing from Epic and it's informed many of Unreal Engine 4's most valuable features geared toward productivity. I'm also looking forward to playing *Daylight* from Zombie Studios, as well as Lionhead's *Fable Legends*."

These are just a few examples of the experiences we can expect to enjoy over the course of the next 12 months, but they're also just the first steps on a long road for Unreal Engine 4. Partly created to weather the ensuing cycle of console hardware, it should sustain what is set to be close to a decade of game design. Whether big or small, no matter the platform, the potential for game developers across the world to sculpt more vivid and stunningly interactive worlds has never seemed so attainable.

"Some of the more impressive things I've seen accomplished with the Unreal Engine over the years have come from our licensees and development community," Willard concludes, looking ahead at how Unreal Engine 4 will impact game design in the coming years. "The most inspiring part is seeing how other teams take the engine and run with it."

"A lot of behavioural interaction that previously had to be implemented in the code can now be managed by the designers themselves"

Alan Willard, senior technical artist, Epic Games

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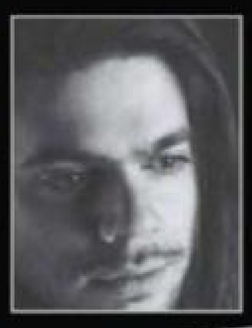
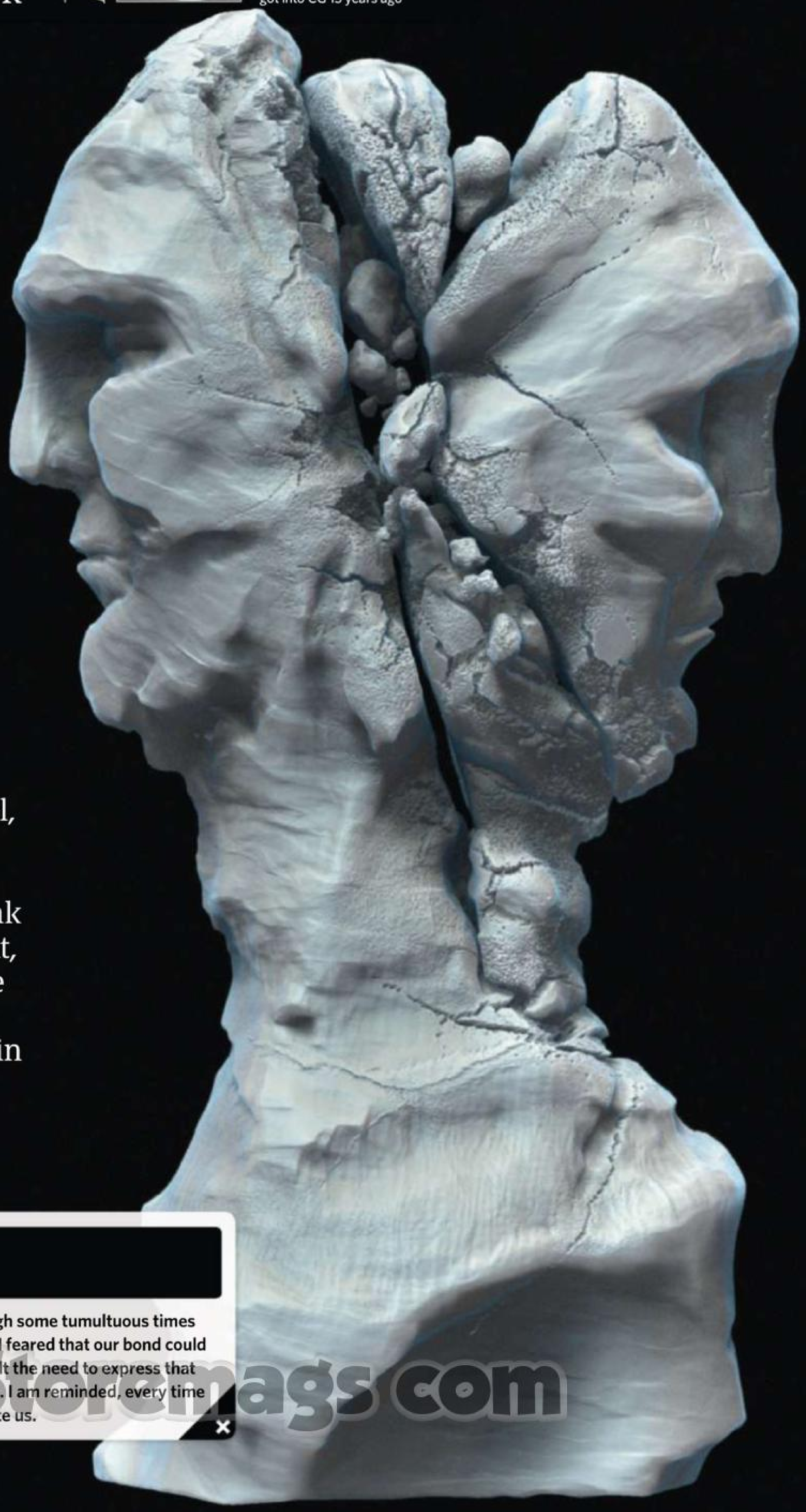


Albert Zablit

Website www.albertzablit.com
Country Canada
Software used ZBrush
Bio Albert is a full-time photographer and visual artist living and working in Montreal. He got into CG 15 years ago



“DynaMesh is a great tool, so experiment with it as much as possible. It’s liberating not having to think about topology for a moment, which enables me to put the emphasis on the emotional impact of my work early on in the process. Sculpt first, think later”

Schism 2013

When I created this image I was going through some tumultuous times with one of my oldest and closest of friends. I feared that our bond could potentially erode and break at that point. I felt the need to express that fear as intimately and universally as possible. I am reminded, every time I look at this piece, of the fragile ties that unite us.

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Step by step

Easy-to-follow guides take you from concept to the final render

Artist info

Yasin Hasanian

Personal portfolio site www.superhero.cgsociety.org
Country Iran
Software used Maya, ZBrush, MARI, Shave and a Haircut, Arnold, Photoshop
Expertise Yasin specialises in texturing, shading and lighting with a solid knowledge in modelling and sculpting

Hair and fur in ZBrush

Cold as Lava 2013

"FiberMesh is just one of ZBrush's many powerful options, so here we'll use it to make a truly photoreal and captivating image"

Yasin Hasanian is a freelance CG artist working professionally in the film and game industries

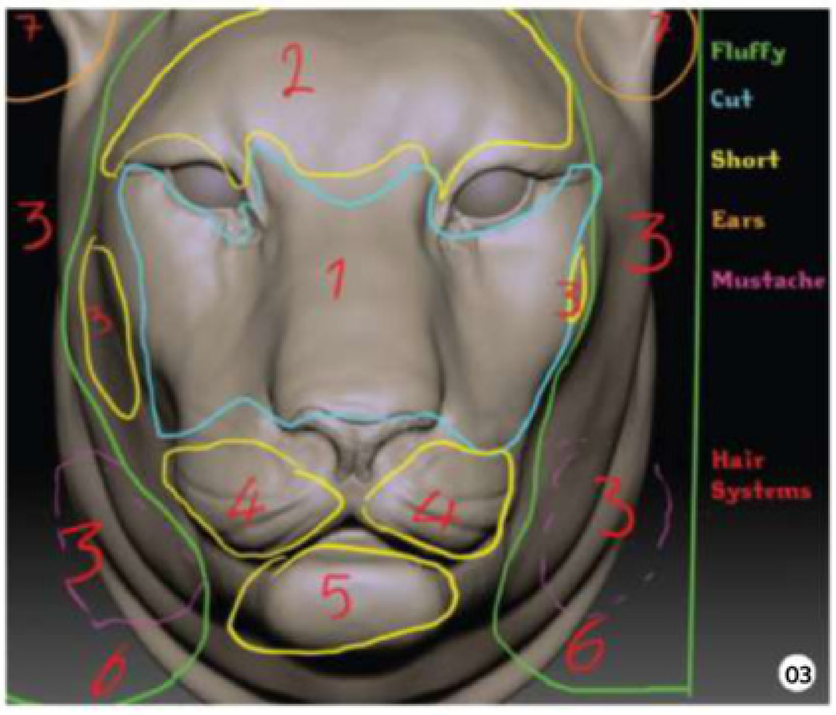
These steps will take you through how to create decent-looking fur with the help of ZBrush. We'll do this by utilising FiberMesh in different stages of the pipeline, using it in conjunction with other software, including plug-ins such as Shave and a Haircut.

Obviously, ZBrush is a program that's constantly evolving with each release. It's become a game-changer for a lot of us by offering optimum methods of accomplishing tasks that are otherwise much more tedious. One of these game-changing features is FiberMesh, which opens up a whole host of options for producing brilliant results beyond just hair and fur.

Regarding other tools that will be used for this project, Maya will be used to set up the scene, Shave and a Haircut for the fur, MARI for textures, Arnold for rendering and Photoshop for post.

Build a concept

Dissect the fur structure and analyse photo references



01 Gather reference images Either you are working on something completely imaginary, or you're working on something that exists in real life. For the former, it's not necessary to find reference images, as they may not actually exist and so you are basically sculpting and evolving your ideas in a program such as ZBrush. For the latter, it's recommended that you gather as many photo references as you can. Good photo references are those that help you throughout most of the pipeline stages. For instance, they will hint as to whether the fur in area X is generally soft, tough, short, long and so on.

02 An overview of sculpting The final Ztool for this tiger has been made available with the tutorial, so we won't go over the minute details of how it was sculpted here. In general, the head was made in ZBrush from scratch with DynaMesh. One thing that you have to make sure of, however, is that if you start your modelling completely inside ZBrush and plan to send the meshes later to another program, such as Maya, check your mesh sizes as soon as you have blocked out the general shapes in Maya. This means you won't have to alter the sizes later when it comes to rendering, as this tends to become problematic in complex scenes.

03 Analyse the references After finalising the sculpt, take some renders into ZBrush to come up with a sense of how to lay the fur on the tiger and what is required for each part of it. As you can see in the accompanying image, there are five main hair types and seven hair systems. Each of these hair types require a different hair system, so the whole project can be easily managed. For example, the cyan area has a distinct sharp type of fur, while the green area has a soft-looking fur type.

Some facts about tigers

Tigers can be up to three metres in length and weigh as much as 330 kilograms. One of the most interesting characteristics about them is their striped pattern, which is unique from one to another, just like human fingerprints. Their pattern acts as camouflage, helping them to successfully hide in the wild from predators. Also, not all tigers are orange in colour. Due to a mutation in colouring, there are tigers that feature black stripes and blue eyes. One significant advantage that the tiger has is their eyesight. They can see just as well as humans during the day. However, at night, they are able to see six-times what a human can.

Learn how to

- Work with FiberMesh in a production environment
- Methodically apply realistic hair to a sculpt
- Work with grooming brushes to refine your model
- Work with the Shave and a Haircut plug-in
- Render fur with Arnold
- Analyse photo references

With the Disc

Tutorial files:

- Tiger_ZB.ztl and screenshots of Yasin's settings

Concept

The main inspiration for this work was nature! Tigers are one of my favourite animals and two of their visually striking characteristics are their eyes and fur.

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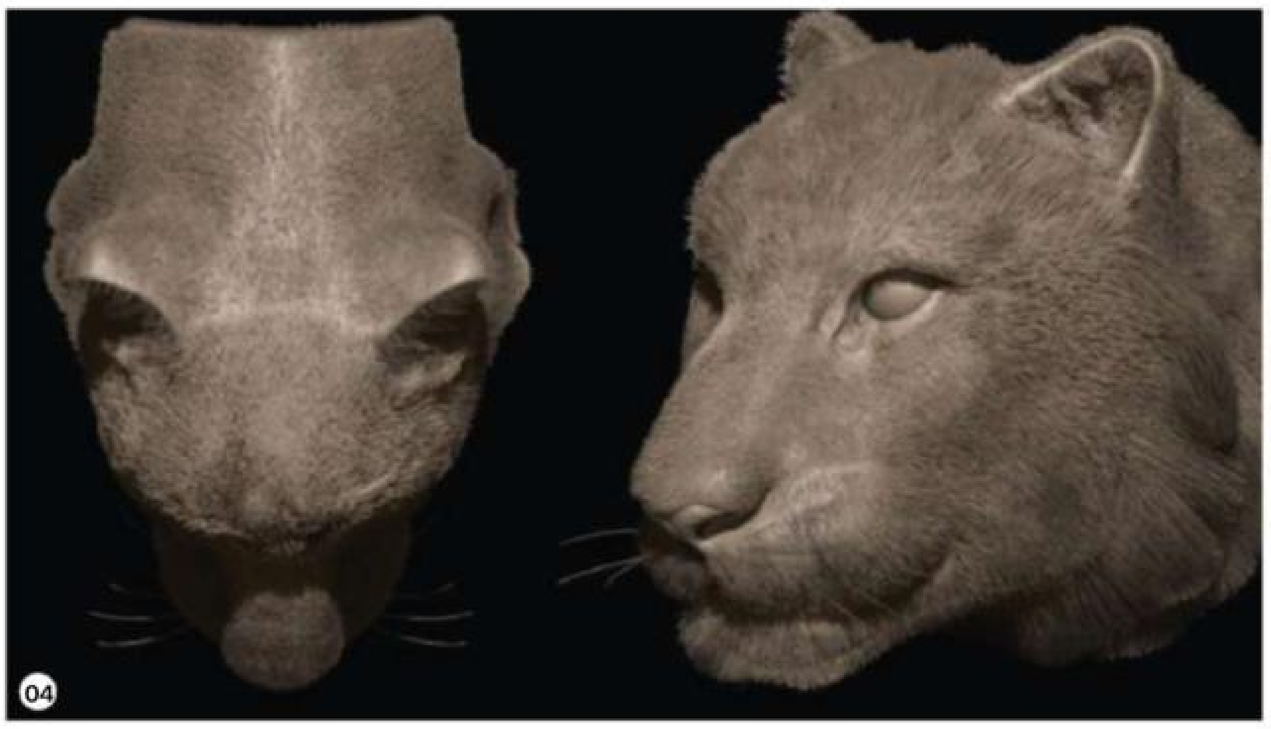
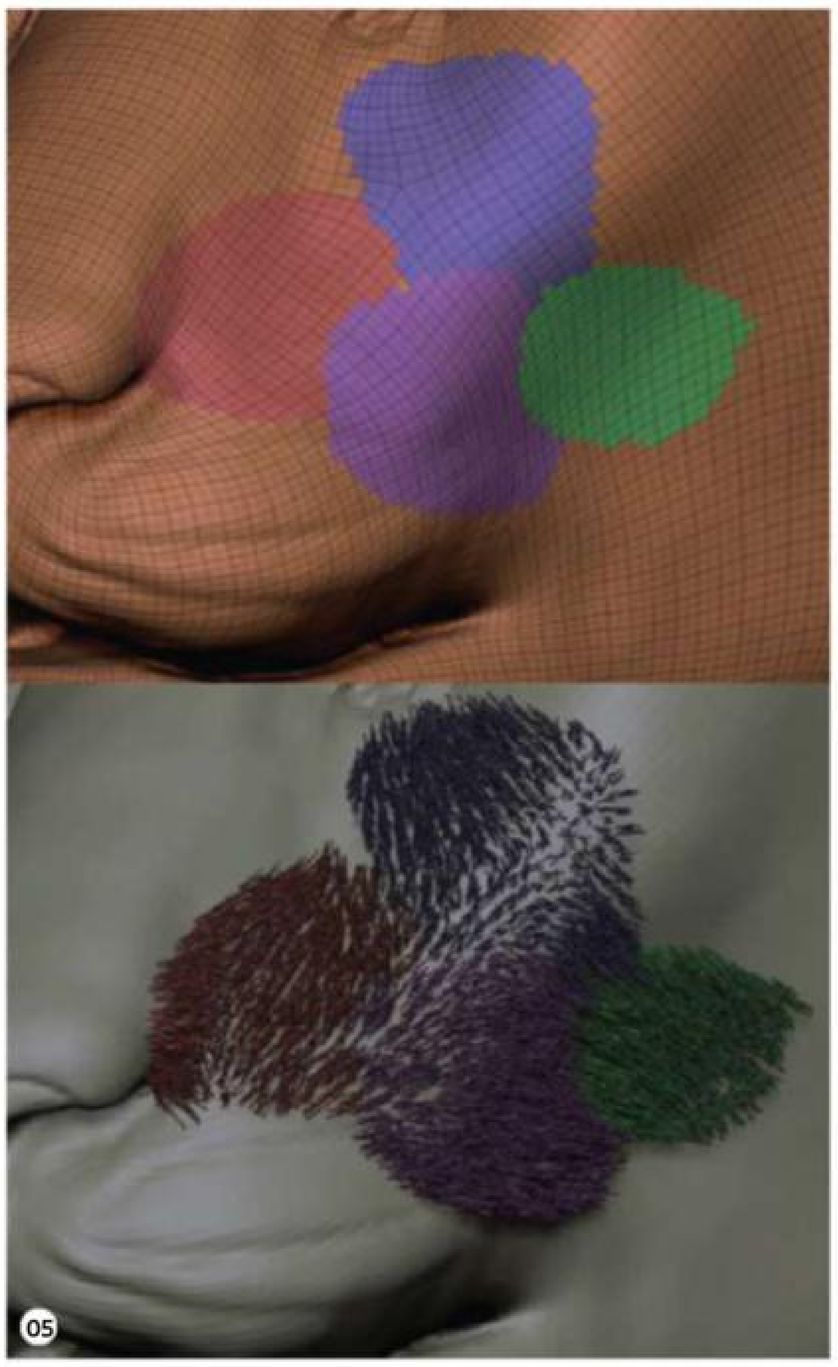
Lay the foundations

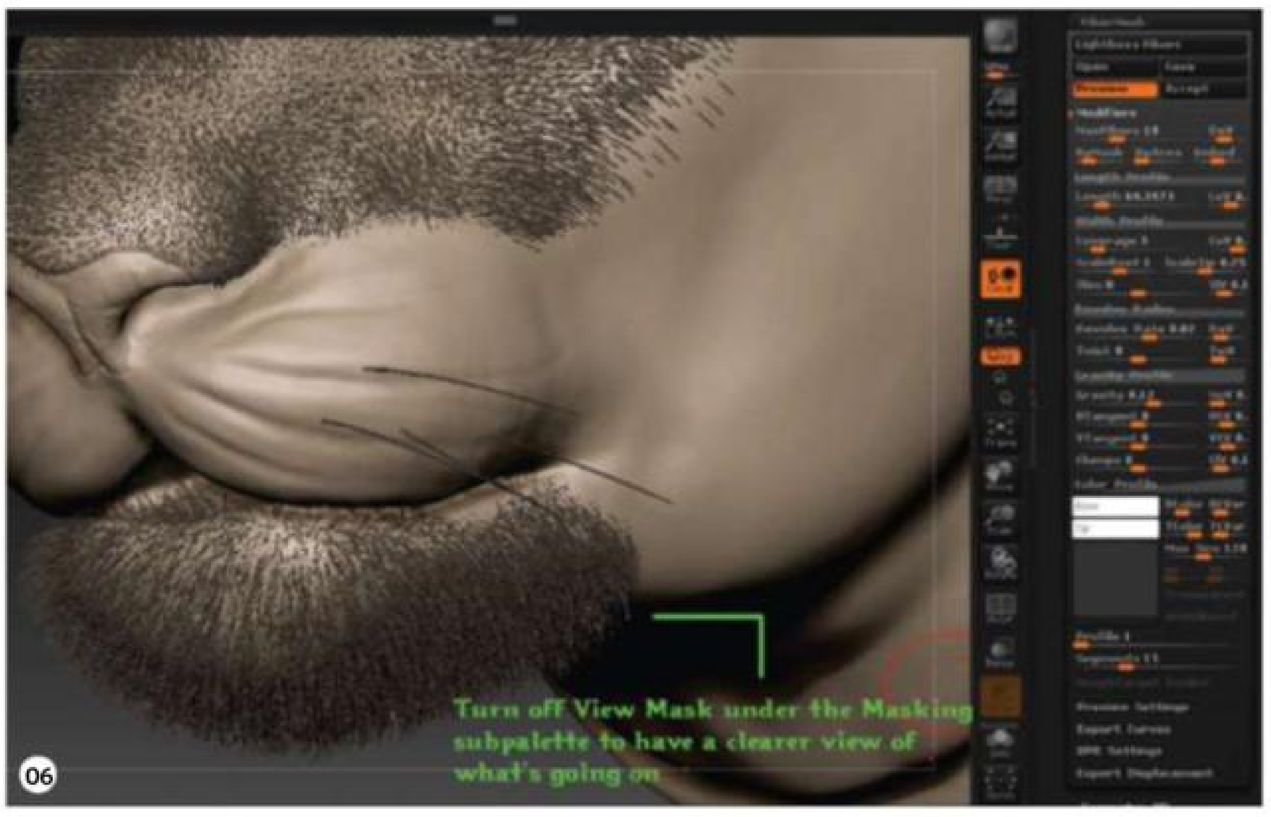
Pre-visualise fur in order to get quick feedback

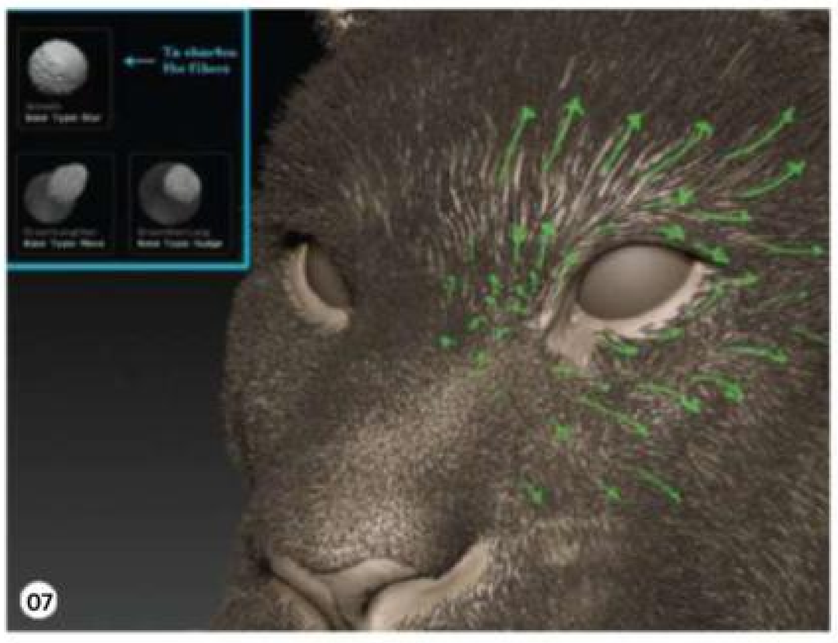




04 Begin your pre-vis Often you are required to give quick feedback to your client or to make sure you're on the right track, which means visualising how the work, in this case the fur, is roughly going to look. Before the introduction of FiberMesh, there was no easy way of going about this. For example, completing this phase directly with Shave and a Haircut could definitely take a lot more time and was prone to errors. Now you can quickly apply some fur with FiberMesh, groom it and render it through BPR to evaluate its different aspects.

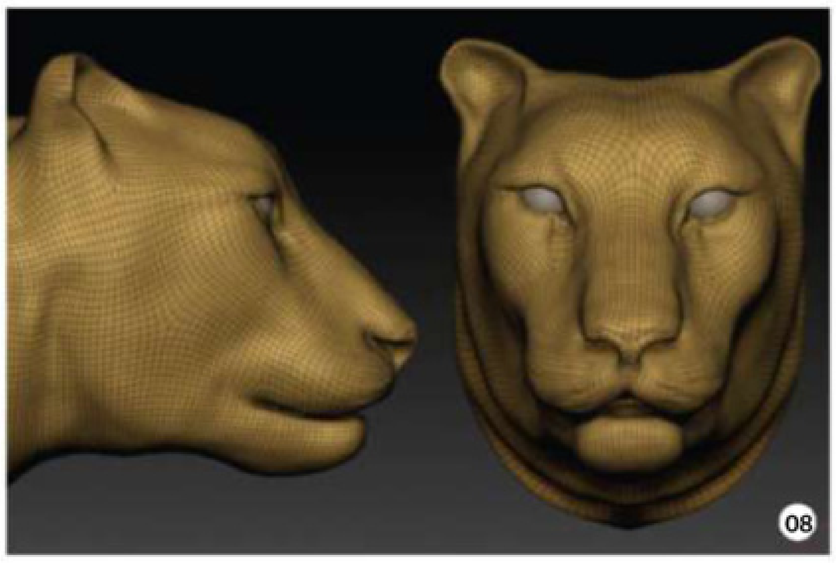
05 Optimise FiberMesh In situations where there are multiple fur types or sections on a character, there are essentially two ways of organising FiberMesh elements to separate them. The first method is to make polygroups on your sculpt for certain regions that have different types of fur and then, when the FiberMesh is created, the fibres actually respect the polygroups, so you can further manipulate them separately. The second method is just making the FiberMesh sections one by one, which may not be as fast as the previous method but enables you to focus better on certain areas.





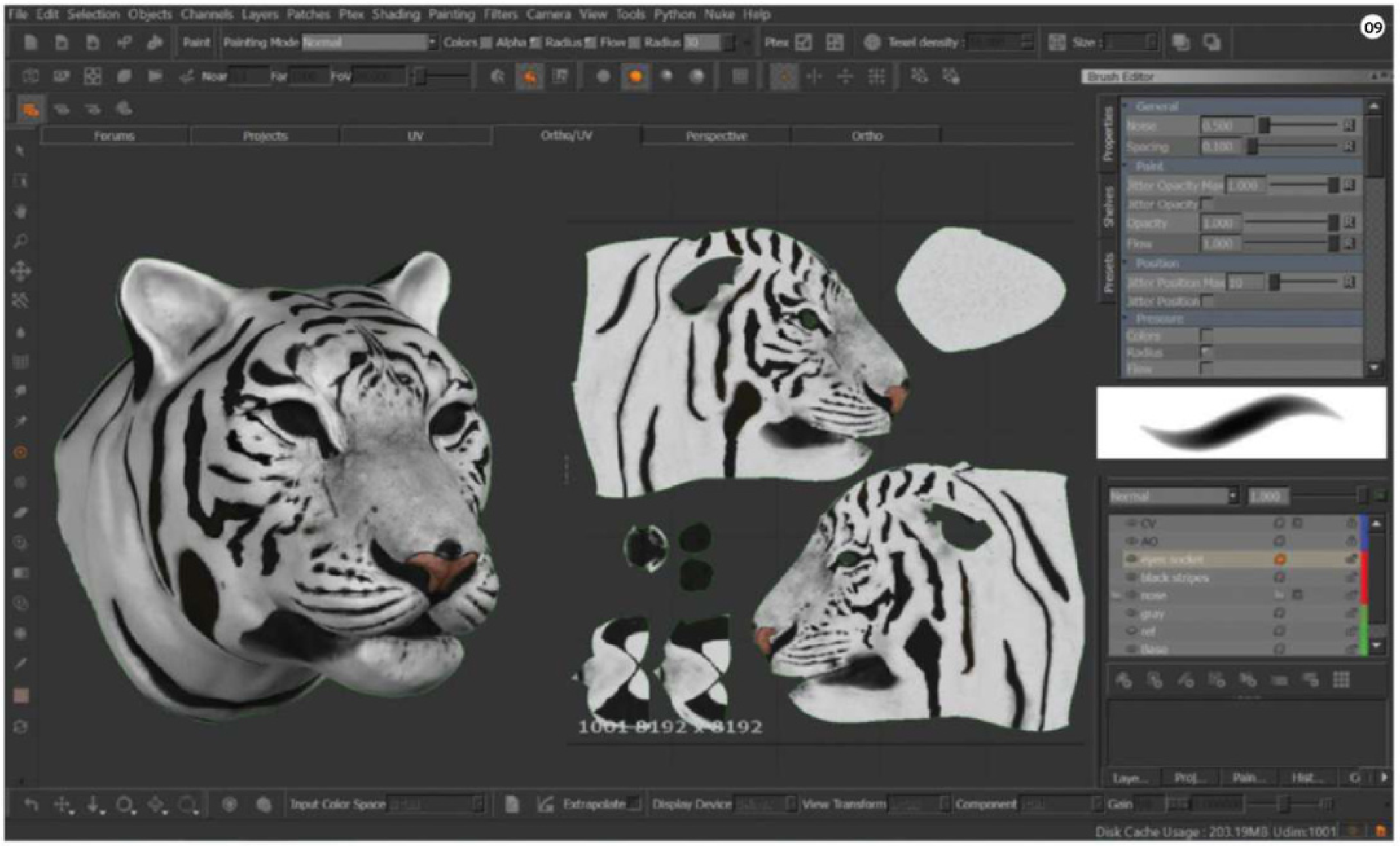
06 Start generating fibres Based on the outlines we came up with in Step 5, we can go over the model and mask each region in turn to grow fibres from. Usually, on the FiberMesh Modifiers tab, it's best to zero out any sort of randomisation at the start to avoid an unwanted result and to build up the look manually. Since we're still on the prototyping stage, the idea is to work as fast as possible without worrying too much about details. After accepting each of the FiberMesh sections, we can groom them with GroomHairLong. Although the fur isn't actually long, this brush is perfect because it enables more control along each strand's length.

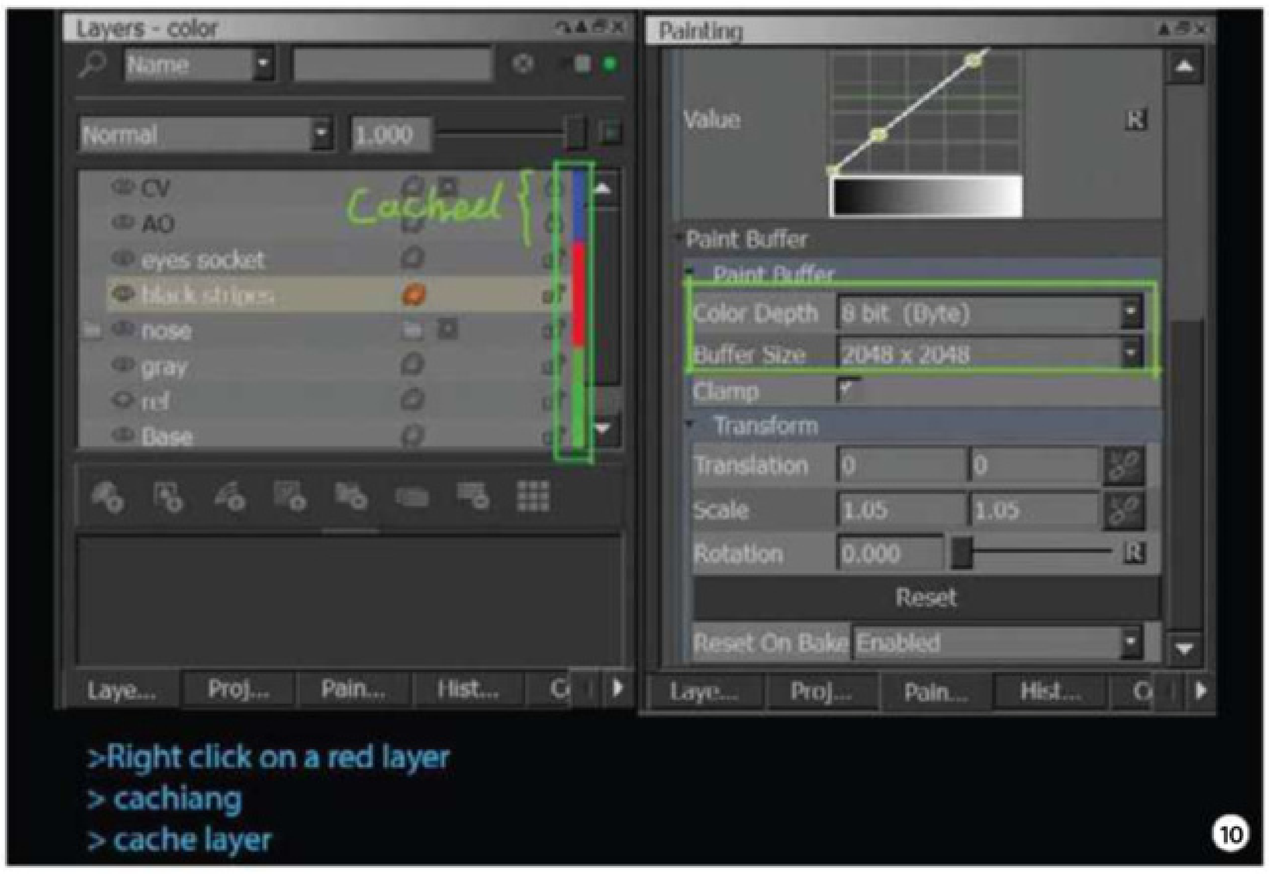
07 Groom the fibres into a pattern While grooming the fur in this stage, the most important factors you need to be aware of are the direction of the fur, its coverage (thickness), the length and the density covering a given region. These key factors will really help you sell the piece to the client. The Groom brushes, such as GroomHairLong and GroomHairLengthen, handle the direction and length, while density and coverage should be taken into account in the FiberMesh Modifiers tab. GroomHairLengthen is pretty much a Move brush, so you can use this brush to manipulate the hairs or make them longer as desired.



08 Prepare the mesh After you're finished creating all FiberMesh elements, proceed to make a series of adjustments on the sculpt to make the head read better, then retopologise it with the ever-useful ZRemesher by holding Opt/Alt to preserve asymmetry. This step could have been completed sooner in the process, but due to a high probability of model changes in the prototyping stage, it's much better to complete it at this step. Please note that you can simply skip this step if you are following the tutorial using the tiger ZTL file provided.

09 Move to the texturing stage At this point you can begin building up the textures. Most of the time it's good to paint textures in a 3D texture-painting application, such as MARI or BodyPaint, in conjunction with Photoshop. Send 2 subdiv levels of the tiger head, both low and high, to MARI (or your program of choice). Work on the low level to block out the colouring and switch to a higher level of subdivision to work in the finer details. All the textures here were hand painted in layers, leaving enough freedom in case of a texture alteration.





10 MARI performance tips If you are experiencing any lag or difficulties when working with MARI, try decreasing the Frame Buffer size. Moreover, in normal texture painting you don't really need to paint in 16- or 32-bit buffers, so try switching to a lower Depth Buffer in order to free more resources on your graphic card. Caching layers have a red sign that indicates they are static and not in use any more. You can always un-cache them later in case you need them.

Volume illusion

If you are working on a furry creature based on reference images, always be mindful of the volume and shape of what you are sculpting. For example, if you match your sculpt completely to a reference image on the silhouette and later decide to add fur to it, you will most probably get incorrect results. This is because you're adding another layer of silhouette on top of the character, making it look fuller. Sometimes you might be able to cope with this later by an overall negative inflation.

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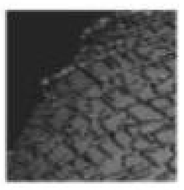
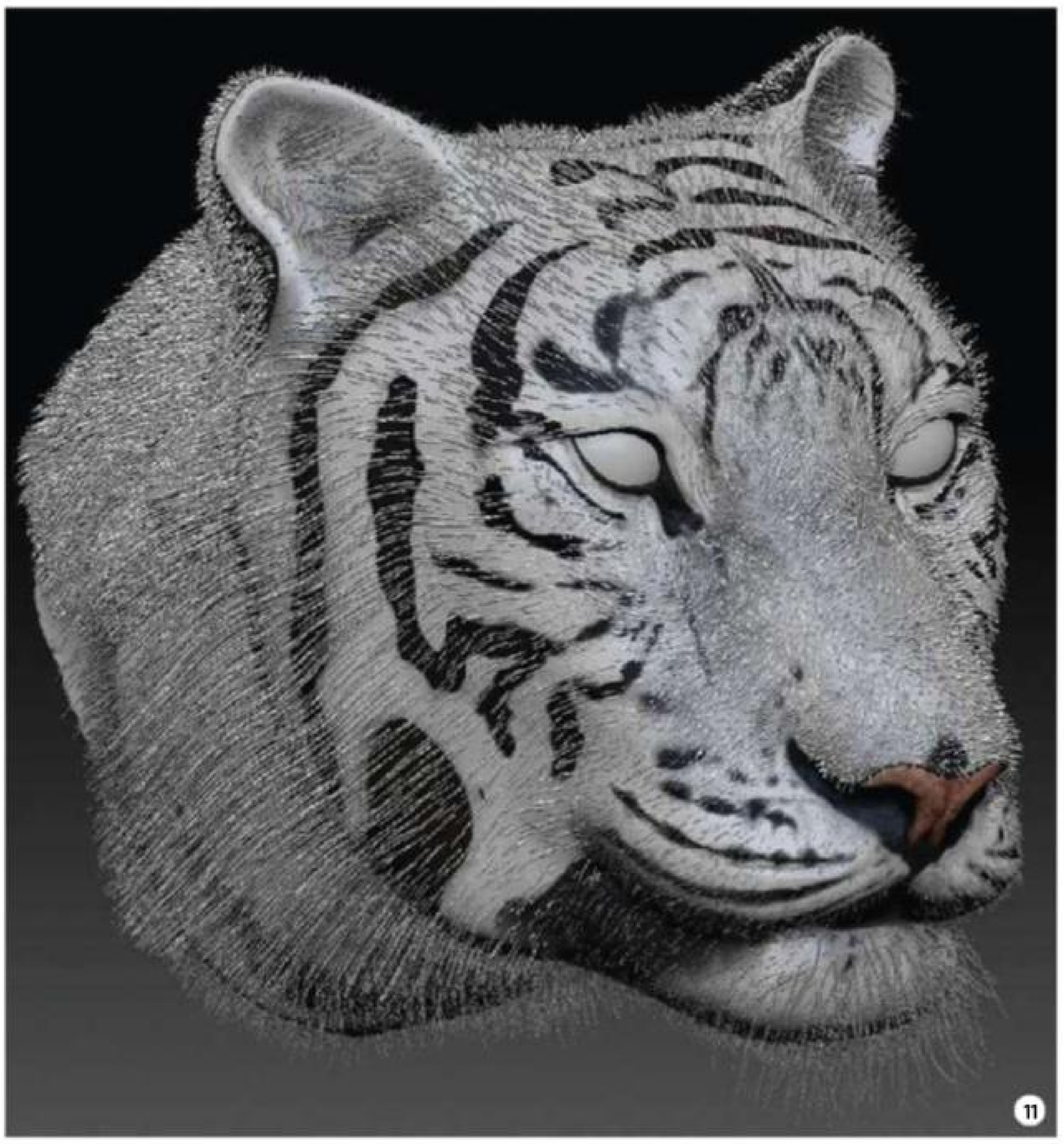


Further refine the fur

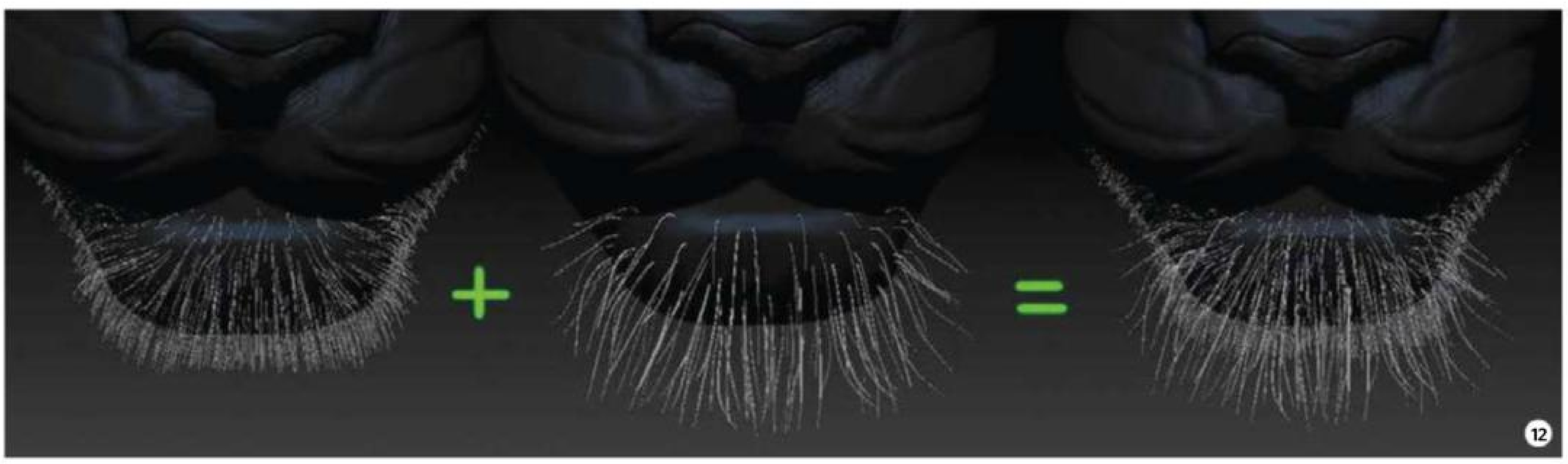
Make FiberMesh ready for Shave and a Haircut



11 Continue building FiberMesh elements The second version of FiberMesh regions can be created with Shave and a Haircut in mind. Here the accurate appearance of the fibres is imperative. In contrast to the previous type of fur, here we want to exhibit less density and use more precise grooming. For the previous version of fur, most of the time was spent in the FiberMesh Modifiers tab, whereas here the time is spent on grooming. The guideline for this round is still the Step 5 figure, with perhaps some minor alterations after the prototyping stage.

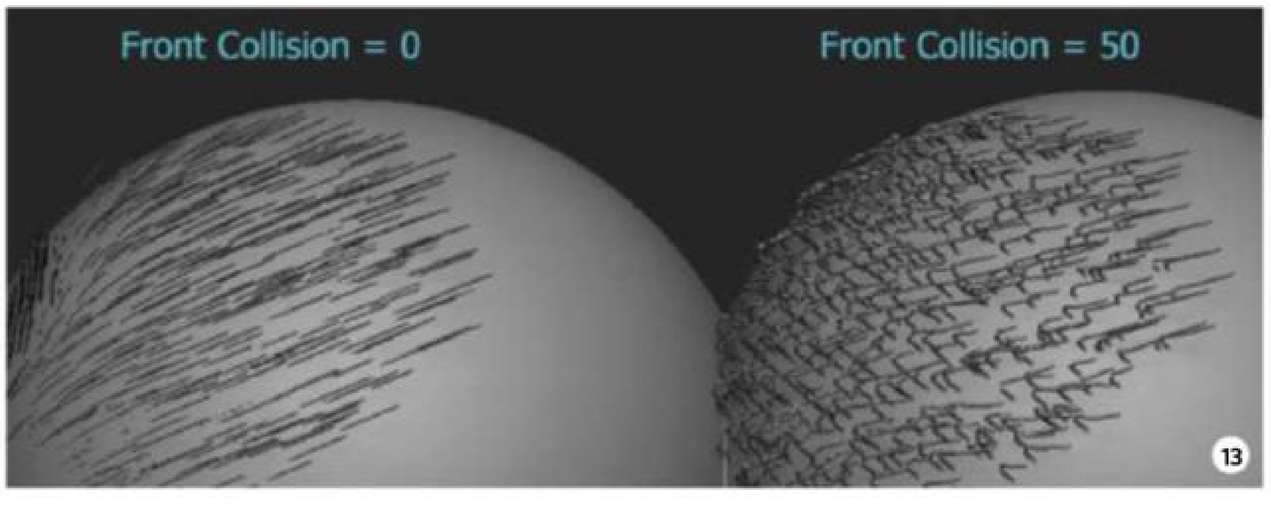
12 Layer the fibres Some areas on the tiger fur have a layered FiberMesh set up for higher fidelity in the look development, as well as to have Shave work as expected. Without this, Shave doesn't really know how distinct the two fur types should be, resulting in a uniform interpolation between the strands. An example of this layered style took place on the tiger chin – one layer with a dense, short FiberMesh and one with less-dense and longer elements.

13 Adjust the grooming brushes As you are grooming the fibres while some other objects are visible in ZBrush, you might have noticed the fibres do not fully respect your brush movements and end up with a scraggly look. This is because grooming brushes have the Front Collision attribute active by default. To disable this, go to the Brush palette>FiberMesh and zero out Front Collision Tolerance. This slider keeps away the fibres to penetrate into the object's surface. In fact, Preserve Length in this tab tells ZBrush to treat any mesh the way a FiberMesh is treated, provided that it is enabled on a brush.



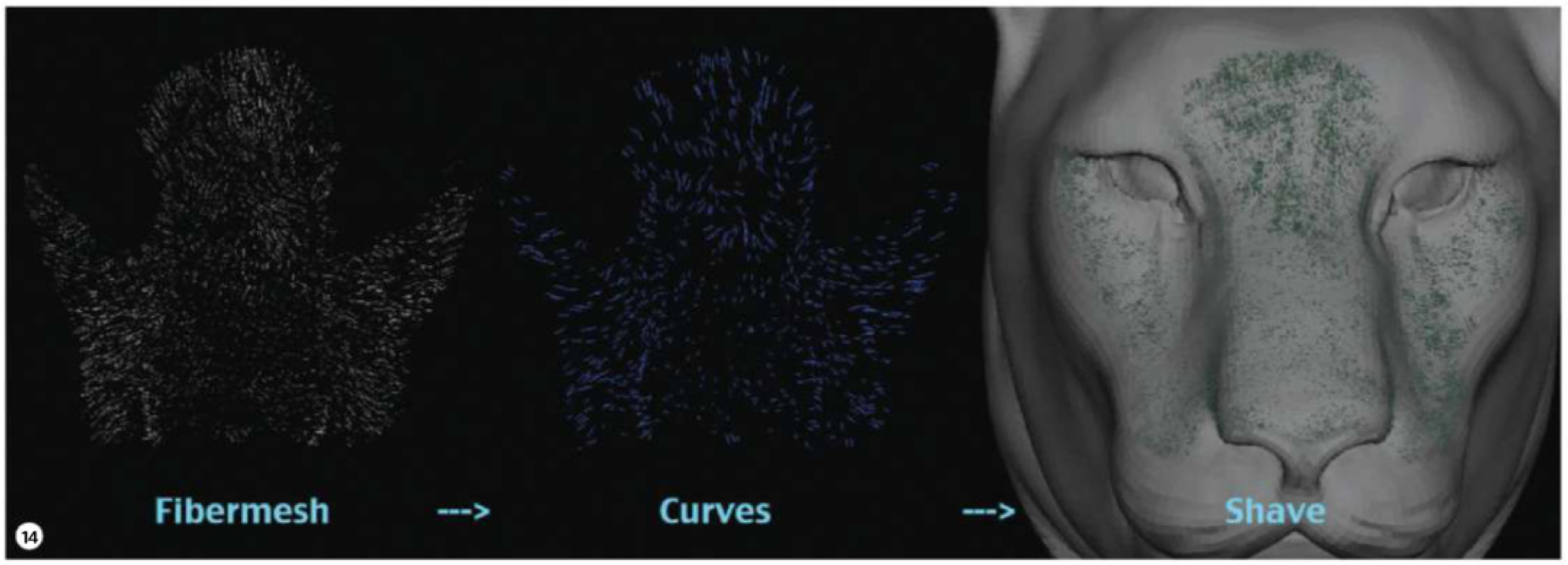
Shave and a Haircut tools

S&H offers a bunch of brushes to comb the hair, but here the only brushes I used were Translate, Scale and, where the strand moved inside the geometry, Stand. Aside from the brushes, the Shave selections came in handy when I wanted to accurately comb the fur, by switching to Component mode, clicking on a selection mode and manipulating the guides one by one or as a chunk. Still, a major drawback of S&H is the limited Undo feature. As such, if you plan to do a major combing, save your scene!



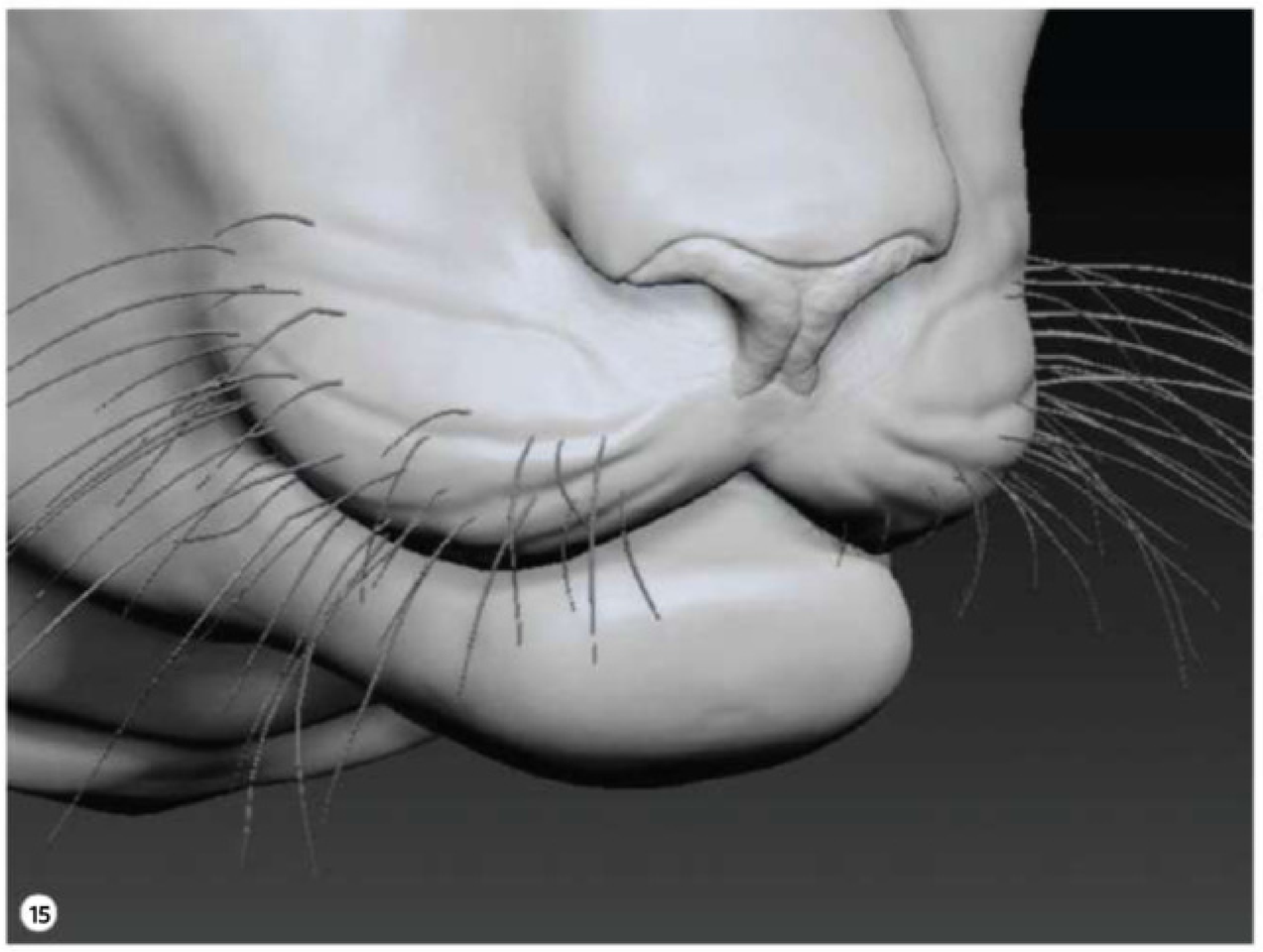
Fit the pieces together

Prepare the tiger fur ready for rendering



14 Set up the scene in Maya Now send all the parts to Maya to prepare them for rendering and export out all the FiberMesh elements to serve as guide curves for Shave. In order to convert the fibres to curves, you can use this script: **tinyurl.com/TDAHairAndFurScript**. This is why the second version of FiberMesh elements were quite sparse. For each section of the fur, extract a root geometry from the low-res head, grow Shave out of it, then comb the Shave with the curves created out of each corresponding FiberMesh. Additionally, you can make Control maps, such as Density, to further refine the Shave nodes.

15 Add whiskers Regarding the whiskers, you can totally rely on FiberMesh from the start. Toggle the Brush Size to Dynamic mode, move to the highest subdiv level and begin masking strong little dots on the places you want the whiskers to grow out of. Next, preview them and, back in the Modifiers tab, tune it in a way that only one strand per dot grows. Afterwards, give them a Profile of 6 and Segment of 10 because we're going to render them directly and not convert them to guide curves. To finish this step, groom and export these elements to Maya.



Artist Showcase

Yasin Hasanian

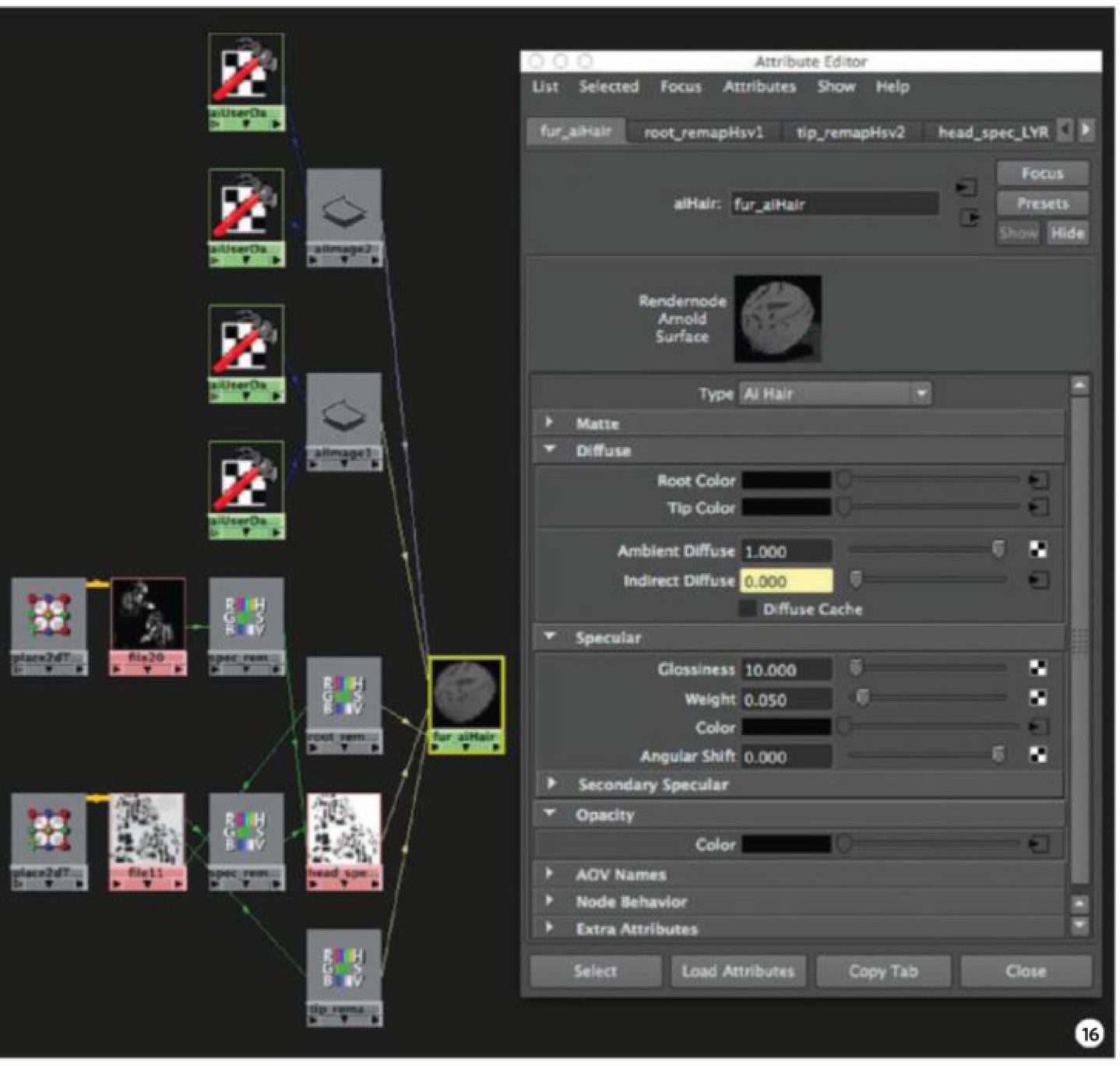
Yasin was born in Iran in 1990. He has had a great passion for both the art and science behind CG since he was 14 years old. He holds a bachelor's degree in Computer Science and has been working as a freelance CG artist in the industry for over five years. Yasin has created work for major clients, but he still wishes to one day land a job at a big studio.

Miss Mutation **Maya, ZBrush, mental ray, Photoshop (2011)**
Maya was used for the base mesh and scene setup, ZBrush for sculpting and Photoshop for texturing

Say Cheese to the World **Maya, ZBrush, Shave and a Haircut, mental ray, Photoshop (2010)**
Sculpting and most of the textures were made and hand-painted using just the mouse

Render and post work

Modify your shaders and set up the final render in Arnold

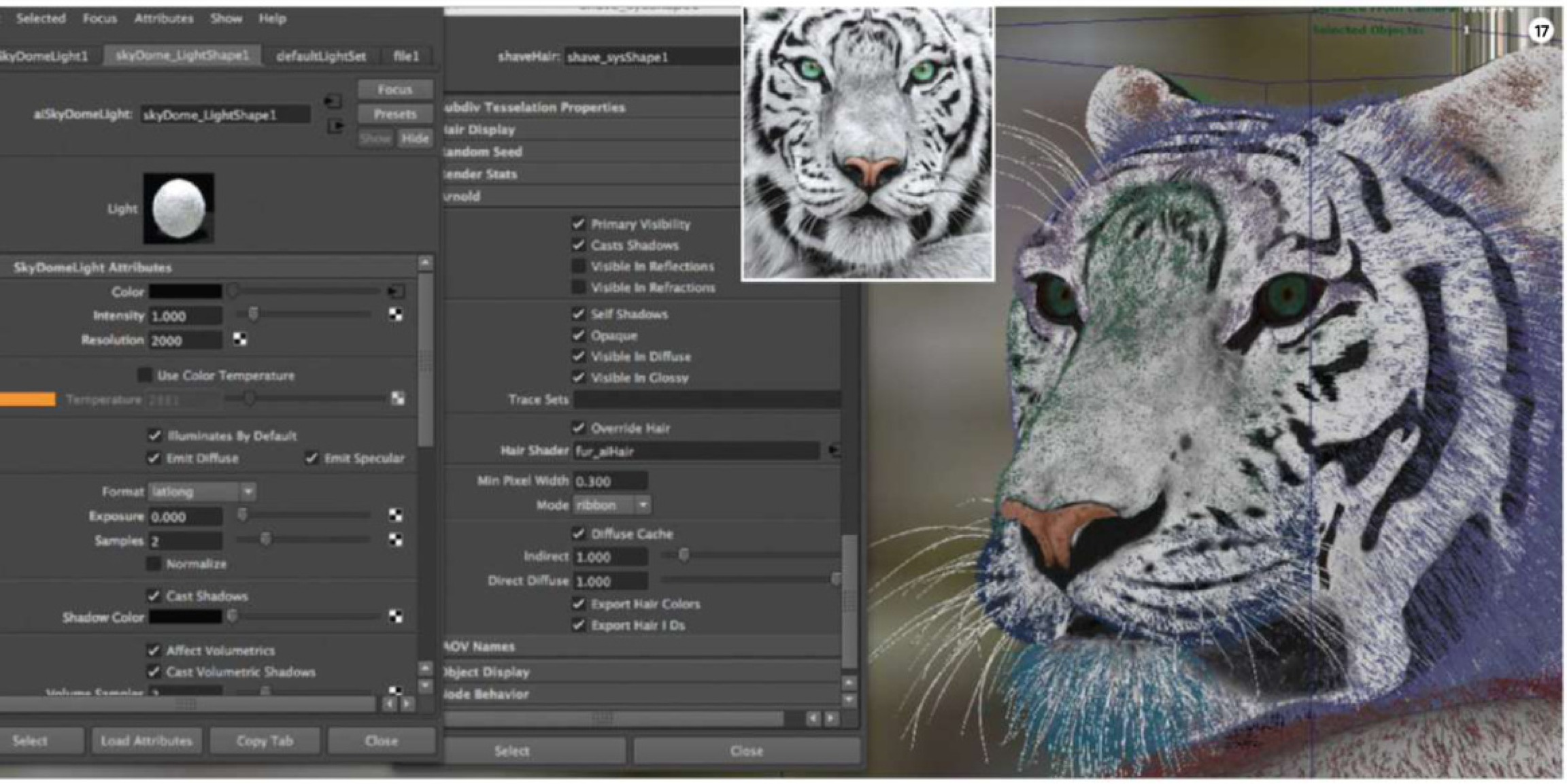


16 Set up the shaders Here the Arnold aiHair shader was used for the fur. The same colour texture that was painted in MARI was assigned to both the Root and Tip slots, however, each was controlled with Remap HSV nodes. Set the Ambient Diffuse to 1 so that the shader takes the lighting direction into account. Although the physical range for Indirect Diffuse is from 0 to 1, a value of 2 has been used here for artistic purposes. Only the primary specularity was used with low Strength and Glossiness to maintain the shader's energy.

17 Begin the render There's only one Skydome light in the scene with an enhanced HDRI texture, meaning both the Diffuse and Reflection were altered. All the Shave nodes had a Min Pixel Width of 0.3, with the default Arnold Transparency Depth of 10, which is enough to provide a soft look in certain areas. A stand-in of the high-res tiger head with pre- and post-render scripts was used to get switched with the low-res version for rendering, which saved time by skipping the displacement tessellation process.

Arnold and fur rendering

Arnold is an amazing renderer that's optimised and powerful. Arnold works well with fur/hair and its IPR even supports node initialisation. For example, you can simply launch IPR and create your shaders, assign them to Shave, tweak them and it just renders it simultaneously. To control fur rendering artefacts, you can either decrease them by increasing the AA samples or Min Pixel Width. However, increasing MPW too much increases render time, as the renderer has to shoot more transparency rays.



• **DID YOU KNOW?** • All tutorial files can also be downloaded from: www.3dartistonline.com/files

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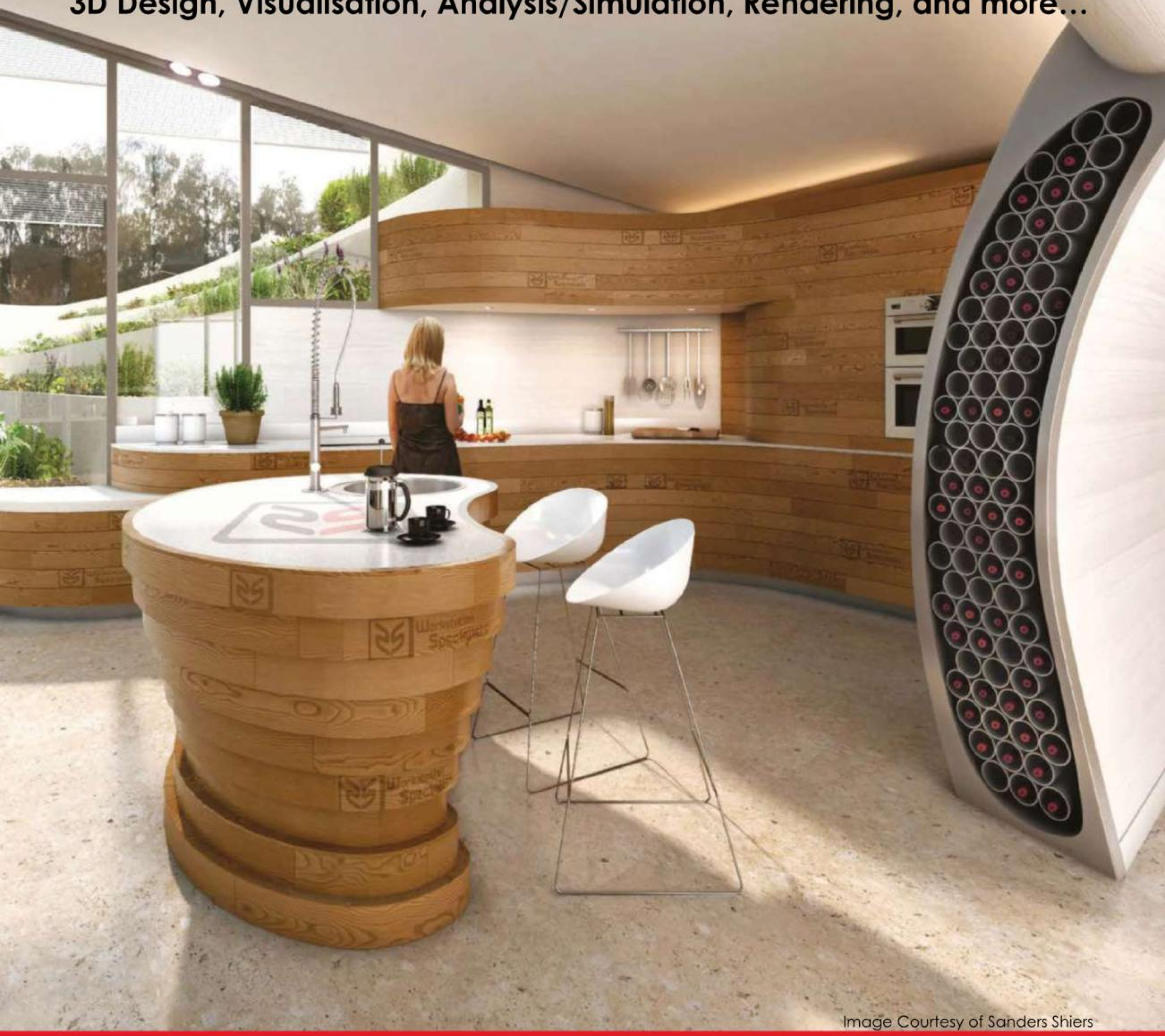

Image Courtesy of Sanders Shiers

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Slicer 2013

The inspiration for this artwork probably comes from when I saw *Transformers* a few years back, especially the concept art created for the movies. One artist that inspired me in particular is Josh Nizzi. I bought his DVD from Gnomon Workshop two years ago and I picked up a lot of his techniques, which have evolved my skillset. This image took me about 15 hours to complete.

I made this...

Incredible 3D artists take us behind their artwork

Artist info

Einar Martinsen

Website www.einarmartinsen.com
Country Norway
Software used 3ds Max, Photoshop
Bio Einar Martinsen is a visual effects concept artist and matte painter who specialises in movies and commercials

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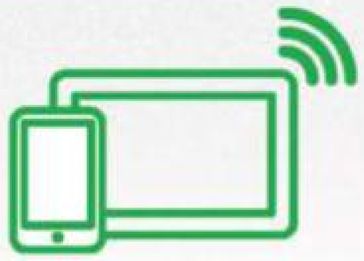

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Step by step

Easy-to-follow guides take you from concept to the final render

Artist info

Brooks Patrick

3DArtistonline

Username: bwpatrick

Personal portfolio site www.facebook.com/cityengine

Country USA

Software used Esri CityEngine

Expertise Specialist in the modelling of urban environments for planning and urban design

Build a city in 60 minutes

CityEngine Sci-Fi City 2013

"Learn how to easily create massive 3D urban environments for your 3D productions"

Brooks Patrick is a 3D solutions engineer at Esri

For those who haven't been introduced, CityEngine is a standalone software product that provides professional users in architecture, urban planning, entertainment, GIS and general 3D content-creation with a unique conceptual design and modelling solution for creating 3D cities.

Esri CityEngine is the tool of choice for the creation of massive 3D city models for movies, TV and games. CityEngine's procedural tools have been successfully used in movies such as *Cars 2*, *Total Recall* and *Man of Steel*.

Matthias Buehler from the CityEngine development team explains that creating realistic 3D models has been a notoriously labour-intensive process, typically involving teams of set designers and multiple specialised software programs. Think of the all the tedious work invested in movies to model cities such as London, Paris, Tokyo or New York, making several hundred-thousand housing units by hand! CityEngine's procedural nature gives you the power to literally make infinite building variations, with full control over all the parameters of each building, including the level of detail.

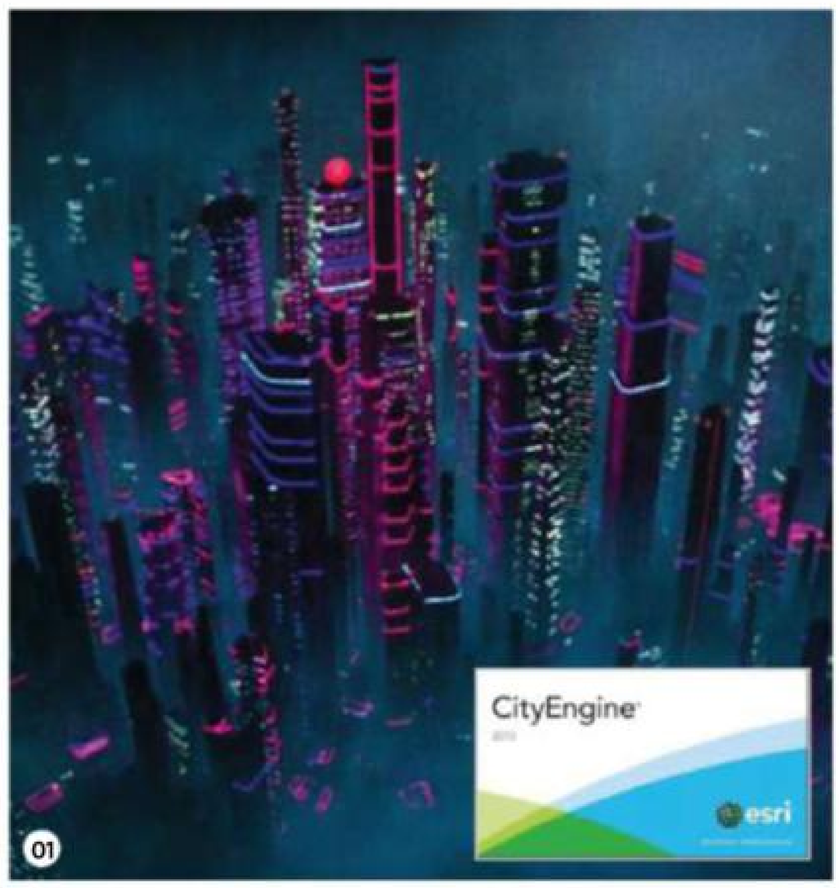
Once your 3D city model is complete, you can export to your 3D package or game engine of choice, using one of many industry-standard file formats. We make sure that with our technology, you can work in a fast and cost-effective way.

Get to know CityEngine

Create massive cities in minutes

01 Dynamic city layouts This guide provides an introduction to those new to CityEngine. First you will need to download your free 30-day CityEngine trial: (**www.esri.com/cityengine**), which gives you the fully functional CityEngine Advanced Version, with full export capabilities, that runs on Windows, Mac OSX and Linux. CityEngine ships with the comprehensive City Wizard, which will walk you through the process of creating your first procedural city. Once you become familiar with the controls, it's easy to lose yourself in the possibilities of city generation. CityEngine offers a library of example projects that will help you on your way, ranging from New York City 2259, to historical examples of a medieval city, or even an archaeological reconstruction of Pompeii.

02 Get to grips with procedural modelling When it comes to procedural modelling, rules offer unlimited possibilities to drive the process and rapidly generate massive cityscapes. These rules are defined in CityEngine's proprietary CGA Shape Grammar, enabling the creation of complex building forms. You can edit and refine the CGA code as needed. The generic nature of CGA provides enough room for a wide variety of designs. Continuous detailing of code fragments will give you the true advantage of procedural modelling – complete freedom of the full city layout, parallel to a guaranteed high-quality mesh.



01

02

Master the city tools

CityEngine is a powerful product that can build amazing cityscapes. Digging into any new software can be tricky at first, however, the more you use it, the easier the functionality becomes. The CityEngine Resource Center is a great place to start as you take on the learning curve and get used to the application. There are example cities, tutorial videos and data templates available, which will help you to better understand and use the software.

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Learn how to

- Get started with CityEngine
- Quickly generate a 3D city
- Assign rules to generate a futuristic environment
- Export to multiple 3D formats for post work

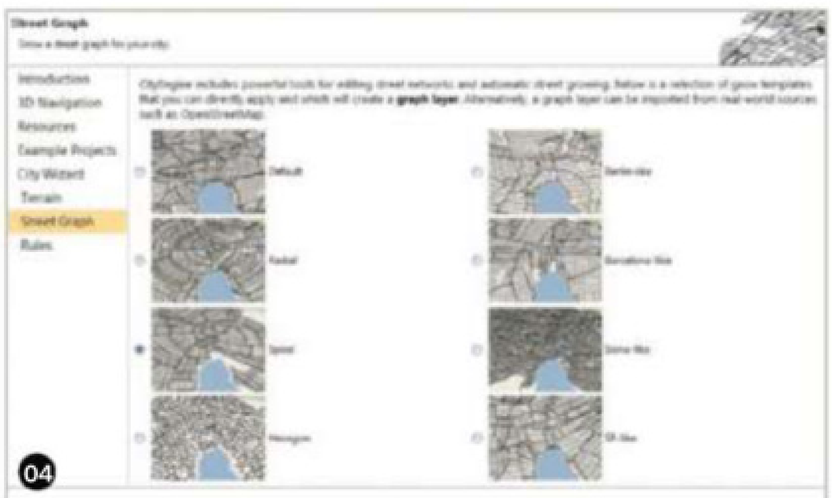
With the Disc

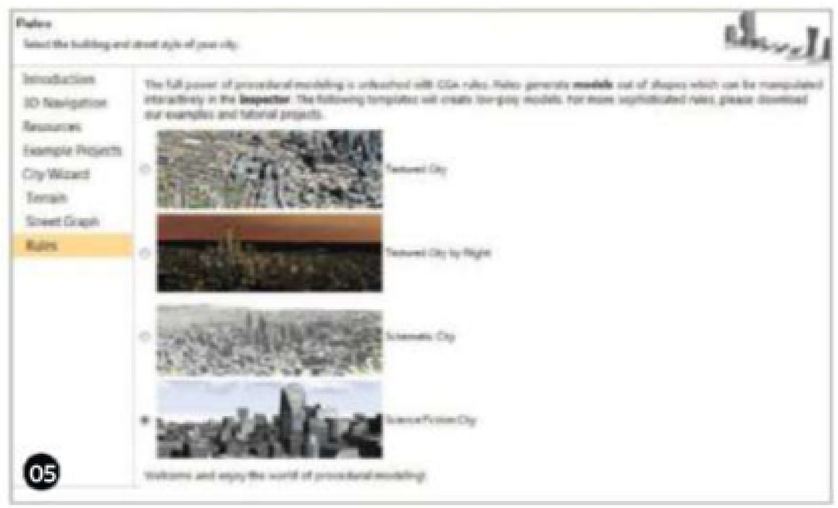
Tutorial screenshots of the various settings used

Generate a city

Set up your first procedural scene with the City Wizard

03 Get started When you open CityEngine for the first time, you will be prompted with the Welcome Wizard. This dialog will let you configure 3D navigation settings and gain an overview of the learning and support resources. You will also be asked to download example projects, so simply click to start the download. We'll be using these again later on in the process.





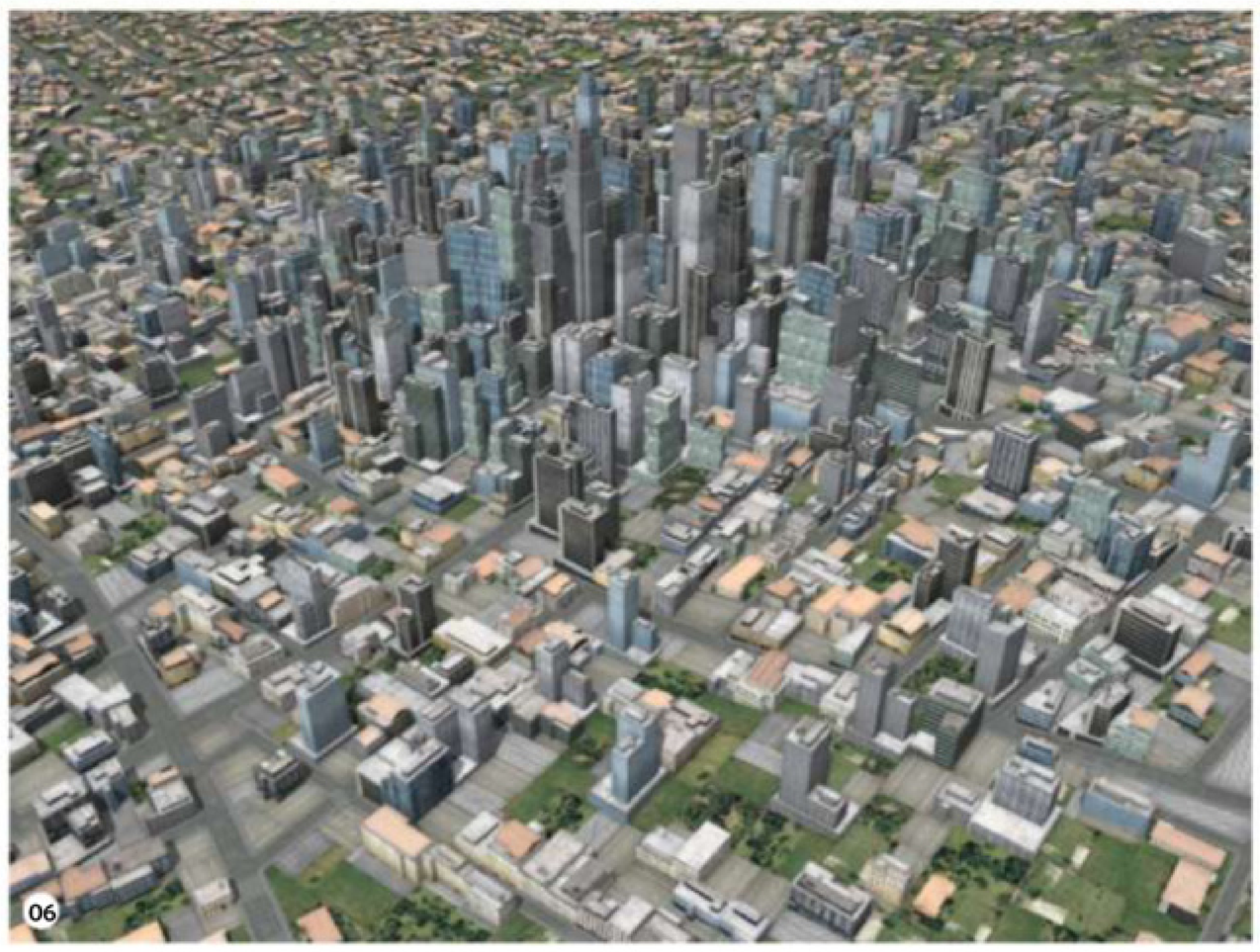
Procedural modelling and GIS

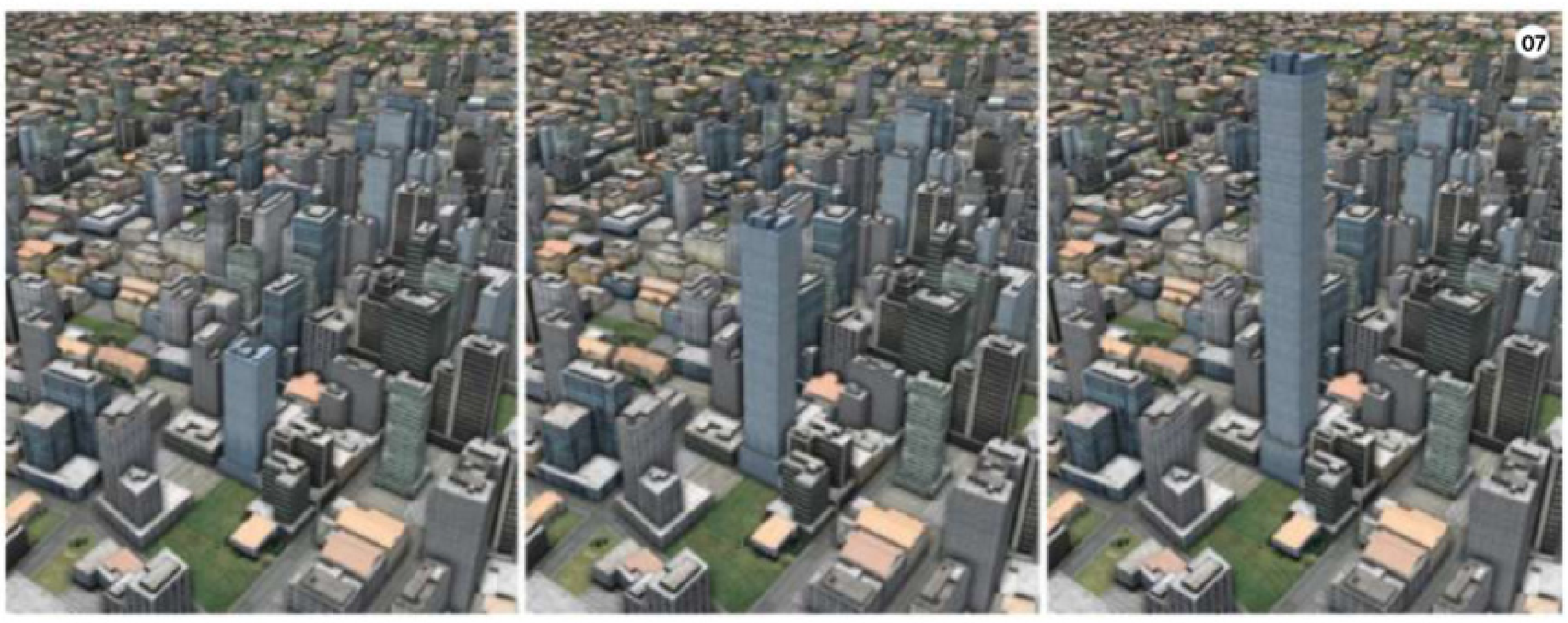
CityEngine is not only capable of creating realistic urban designs entirely within the tool, but also based on imported real-world GIS datasets. Try generating a few cities using the City Wizard, and for those who want to dive in, download and open some of the example cities from the CityEngine Resource Center or import real-world GIS data from a city near you.

04 City Wizard This part of the Welcome Wizard will support you in the creation of your first 3D city model. You will first want to name your city and specify its size (small, medium or huge) depending on what machine you are running. You will then be asked to name your first scene and specify the terrain settings, but let's keep these terrain defaults for now. Next, you need to choose a street pattern to automatically grow your city. Since this tutorial's theme is how to generate a sci-fi city, let's choose the Spiral pattern.

05 Choose your city style The final step of the City Wizard will prompt you with a choice between four different CGA rule sets that will drive the procedural creation of your city model. Choose the Textured City style and click Finish. The Wizard will now generate your city automatically.

06 Essential skills It may take a couple of seconds for CityEngine to generate your city, but you can monitor this process as well as your computer's memory allocation in the bottom-right corner of the layout. For more information on getting started, you can view Tutorial 01: Essential Skills, which can be found on the CityEngine Resource Center.





07 Explore the city Rule parameters

The initial buildings vary in height and structure type, but can be set specifically by selecting one or multiple buildings and altering an attribute in the Inspector. Select one building, frame it (F key) and change its Height parameter in the Inspector window. You can do this to any building across the terrain and find the specific look that you are aiming for.

Concept

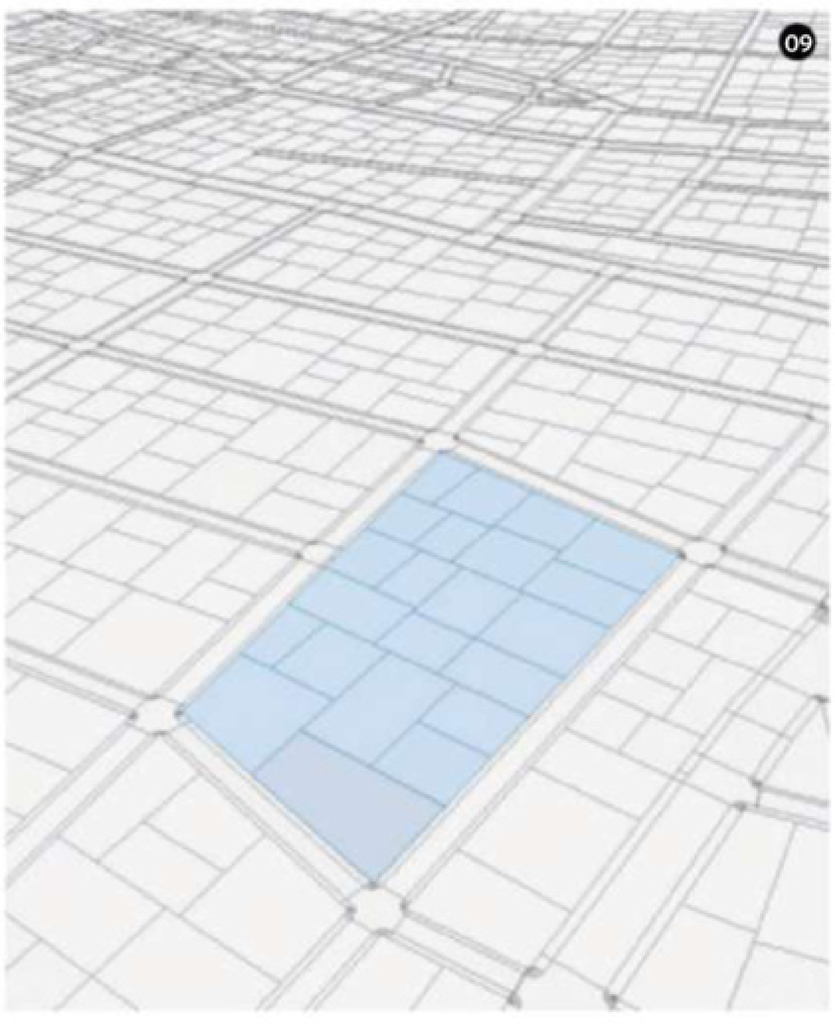
The procedural methodology enables your city models to remain flexible throughout the whole production process, giving you the option to even separate tasks among different artists (layout, mass modelling, façade, roof library creation and so on).

Refine your sci-fi metropolis

Assign rules and develop a futuristic theme

08 Open the example NYC 2259 Remember those example projects you chose to download in the Welcome Wizard? Now it's time to assign rules from the sci-fi project named 'Example_NYC2259_2012' in the city we just created. If you missed downloading the example during the Wizard, you can access it (as well as many others) from the example gallery on the CityEngine Resource Center. Once you have downloaded the example, you can begin importing the project (File>Import>Project>Existing Projects into Workspace). The example will appear in the form of an archive file, so choose this option and select the file from your download location. You can now click Finish.

09 Assign some sci-fi rules Once you have imported the Example_NYC2259_2012 project folder, it should be visible in the Navigator, which is located by default on the left side of the CityEngine interface. Expand this project folder and locate the Rules folder to see all of the rules associated with this example. Select some Lot shapes of one block in the viewport, then just drag and drop the buildings.cga rule onto the parcels. If needed, toggle the Model Visibility switch at the top of the viewport (or hit F12) to better see the parcel and street shapes.



10 Adjust the sci-fi building height When the new rule is assigned, the model will automatically regenerate those typical buildings as sci-fi structures, but you may need to adjust their height. This can be achieved using the same process from Step 7 – by selecting a building and altering the parameters of choice in the Inspector. You will also notice that this specific rule has different attributes than the Textured City rule set, including the ability to adjust the level of detail for a higher polygon count.

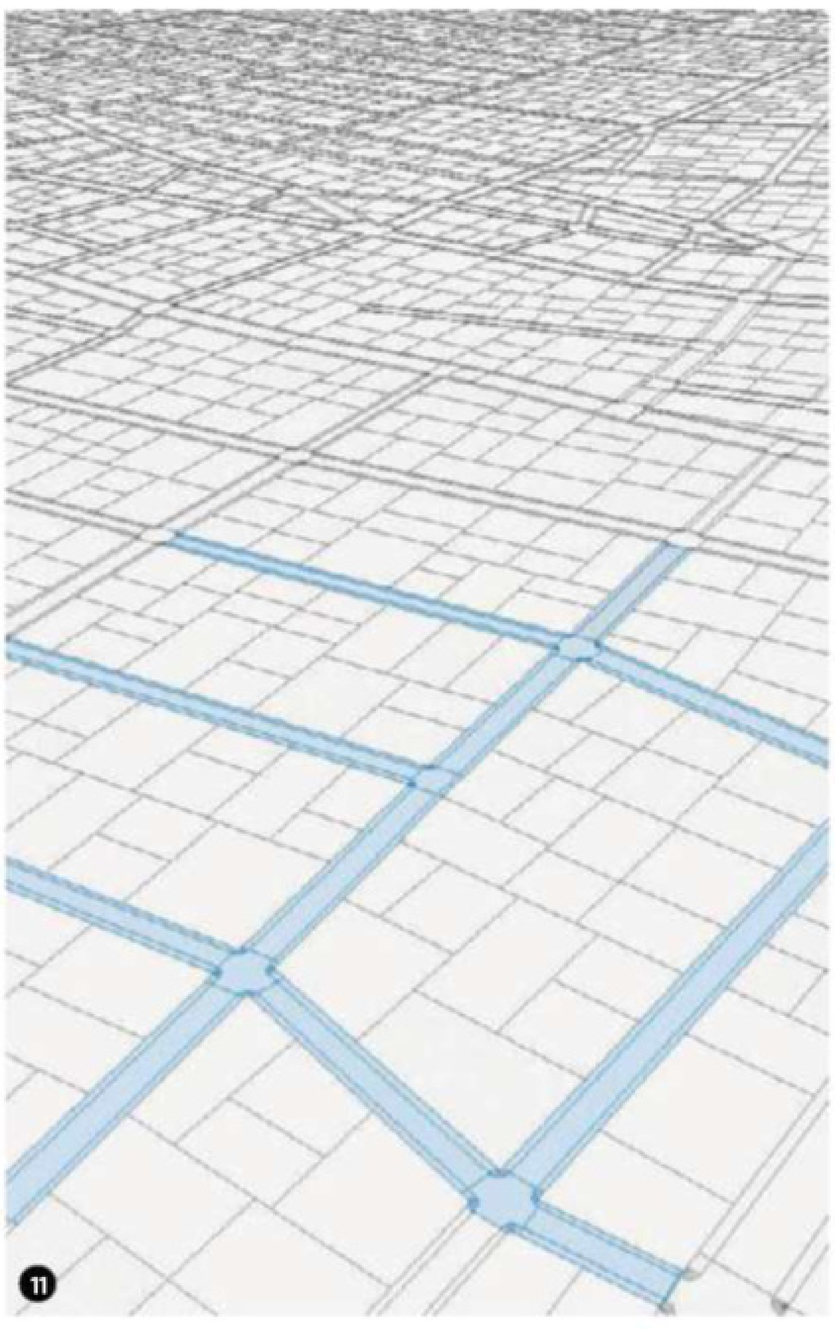
Add extra elements

Include futuristic flying cars and export your city

1 hour creation time
Resolution: 4,000 x 3,200

11 Populate the city with flying cars Now that we have applied the new building rule, it's time to populate the scene with flying cars. Select a few street shapes, then drag-and-drop the flyingCars.cga rule onto them. Flying cars will now start to appear in the scene, making it seem much more vibrant and appealing.

12 Export your 3D city model In the previous steps you have learned how to assign rules to procedurally model a city, even in a variety of predefined city themes. Now you can save an image snapshot directly out of CityEngine by clicking the star (Bookmarks menu) in the top-right of the viewport. CityEngine is also able to export to traditional 3D formats – including KML, COLLADA, OBJ, 3DS, DXF and Autodesk – making it easy to bring the model into your preferred rendering software. Select your area of interest and go to File>Export Models.



11

12

Bring more detail

A very useful attribute in this sci-fi rule is the Level of Detail setting, which can be assigned per-generated model. This ensures that larger sci-fi cities can continue to generate on computers that don't necessarily have a lot of RAM, or that almost invisible details are not even generated on buildings located far in the distance. This saves a lot of precious space and optimises your scene.

Texture a dinosaur in Blender

Pteranodon of the Cretaceous Period 2013

> The goal of this render is to portray the beauty, majesty and terror these creatures would likely inspire if they were alive today

Jonathan Williamson runs **www.blendercookie.com**, where he teaches Blender through tutorials and courses alongside his fellow instructors

Step by step

Easy-to-follow guides take you from concept to the final render

Artist info

Jonathan Williamson

3DArtist online

Username: carter2422

Personal portfolio site
http://cgcookie.com/profile/jonathanwilliamson

Location USA

Software used Blender

Expertise Both organic and hard-surface modelling, as well as a big focus on topology

With the Disc

Tutorial files:

- Final model for part 02: /part02/models/pteranodon_texture.blend
- Final textures: /part02/models/textures/

Learn how to

- Paint with Blender's Texture Paint system
- Use GLSL Viewport rendering to visualise your texture maps
- Create rigs for posing
- Add IK constraints to bones
- Effectively assign custom shapes to bones

Following up the first part of this tutorial series, in these steps we're going to continue working with the Pteranodon model we've created. In this part we will use Blender's Texture Paint system to build the textures for our model. The system works very similarly to the sculpting tools and provides a convenient workflow without needing to switch packages. It's not as full-featured as some other packages, but it will suit our needs well. After the texturing is complete we'll go on to create a simple rig, which will enable us to pose the model for a final render.

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Concept

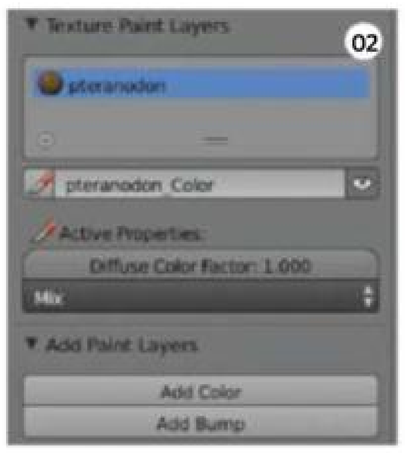
The texturing of the pteranodon should reflect the environment it's from. However, since we don't know much about these creatures, I've chosen to go with neutral tones, adding a touch of red for interest.

Create the Color map

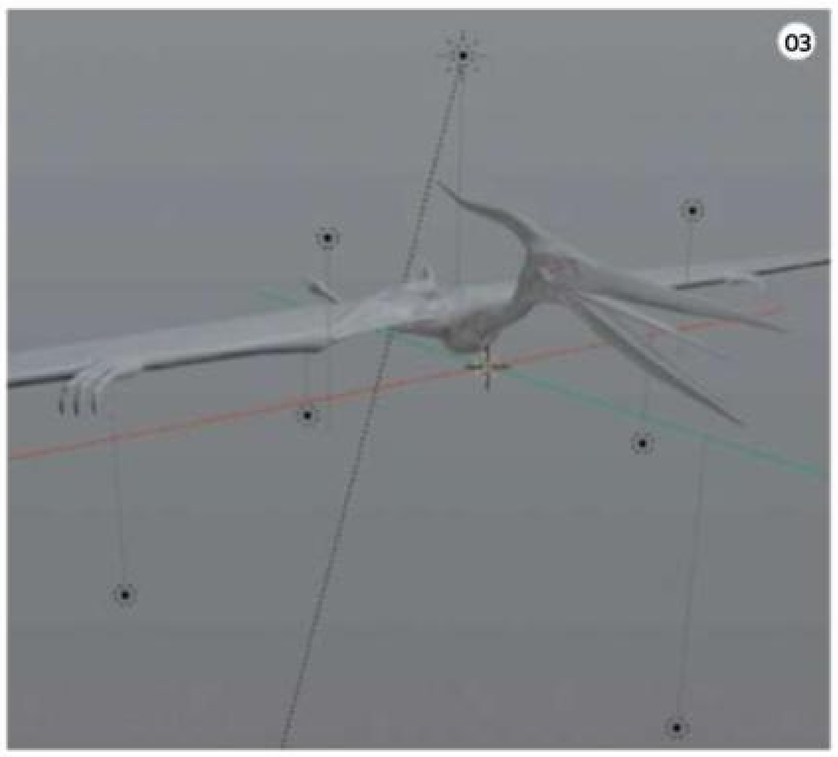
Begin the texturing process with a map

01 Enable Texture Paint Layer Manager Before we begin painting, we're going to enable an add-on that ships with Blender to make our texturing workflow a bit smoother. The Texture Paint Layer Manager add-on gives us easy ways to quickly switch between our different texture layers. It also eases the texture setup process, since by default this can be a bit tedious in Blender. You can find the add-on via File>User Preferences>Addons. Once enabled, you'll see three new panels in the Viewport Properties panel (N). These are Texture Paint Layers, Add Paint Layers and Save All Painted. Note: these panels will only show while you have a mesh object selected and are in Texture Paint mode.

02 Add the Color layer The first step of our texturing process is to create the Color layer. Using the add-on we just enabled, this can be done with one button. Simply select Add Color from the Add Paint Layers panel in the Viewport Properties. If it displays the warning 'Add a Material First', then you simply need to create a material from the Material Properties before adding the texture layer. What the Add Color does is create an image, add it to a texture slot on the active material and then adjust the settings to use UV mapping and affect the correct channels.



03 Light the model With the Color layer added, we next need to light the model. This will give us a good, evenly lit view of the model in the viewport while we're painting. We'll do this using a series of lamps and GLSL Textured shading. All that needs to be done is to add a Sun Lamp and a series of Point Lamps to evenly illuminate the model. The Sun Lamp acts as the primary light source pointed slightly backwards. The Point Lamps then work to illuminate the shadowed areas so that we can see what we're working with. Once the lights are added, be sure to switch from Multitexture to GLSL for the Material mode under the Viewport Properties' Shading tab. Normally we would simply paint in Multitexture mode, but by using GLSL we can layer several textures together and see them all stacked properly.



Paint large patches from the UV Image Editor

In Blender 2.69 there is no Fill tool for painting, which can make painting large patches of the same colour quite tedious when tackled from the 3D View. I suggest painting these parts from the Paint mode of the UV Image Editor, or by laying down the base colours in another paint application. Thanks to this year's Google Summer of Code, Blender will soon be receiving many texture paint improvements, including a Fill tool and Color Swatches. However, these features are not yet ready for inclusion.

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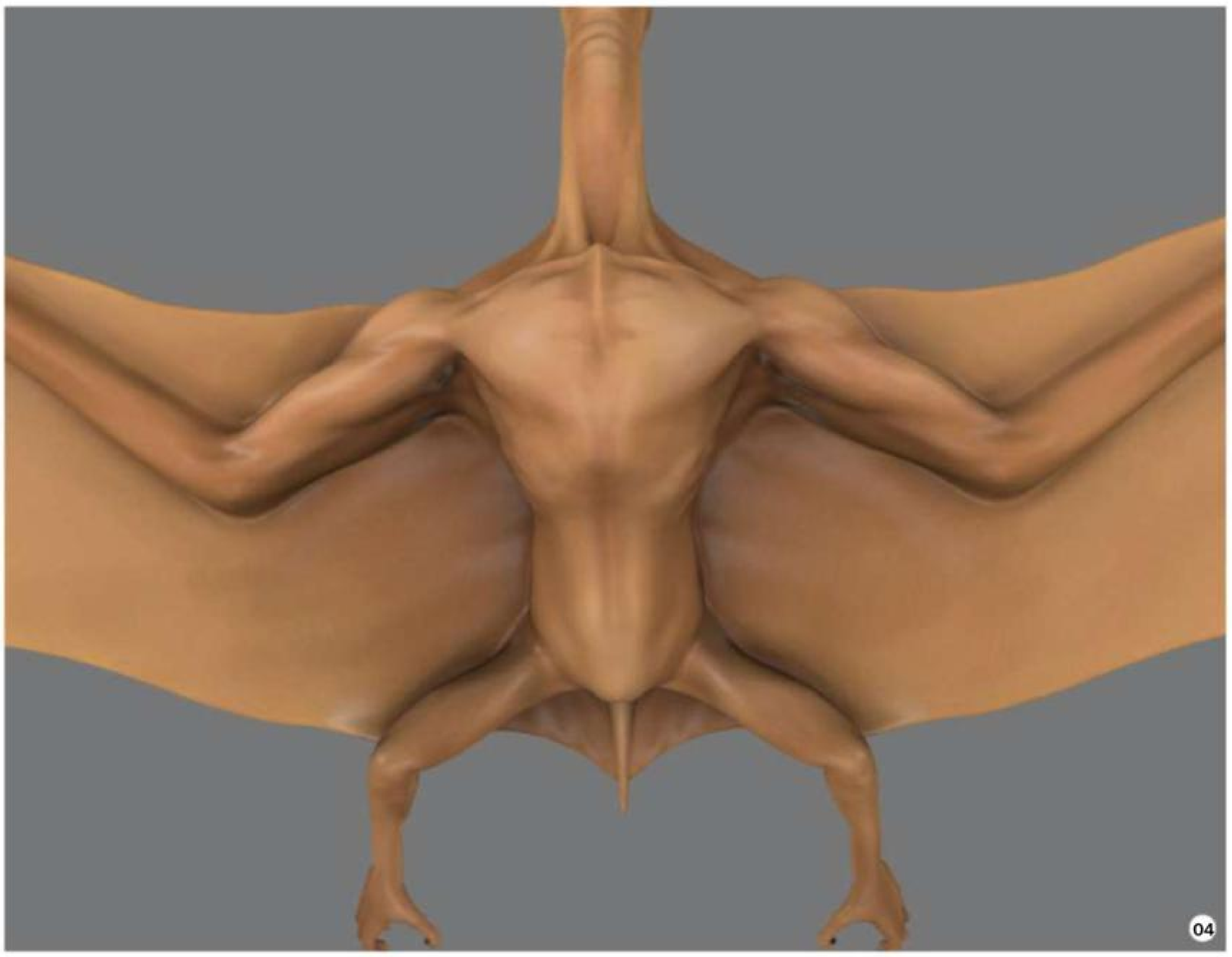
Balance the tones

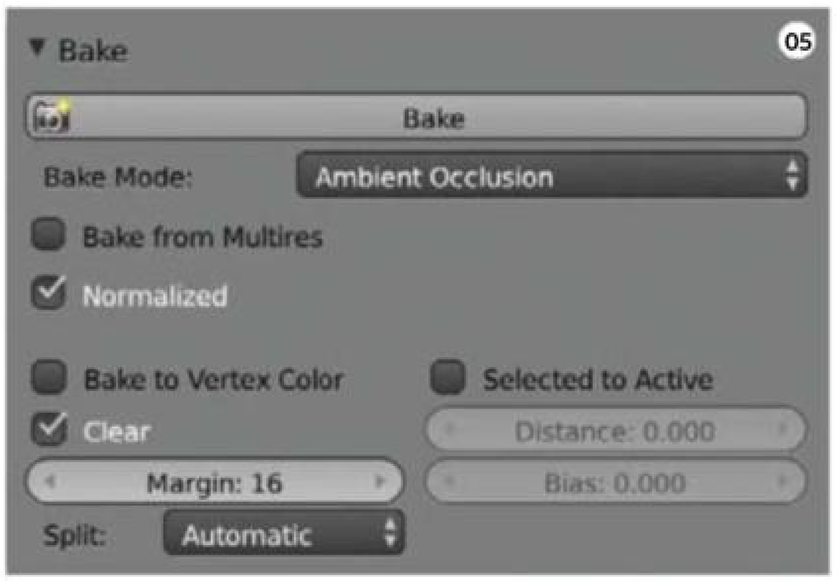
Prepare the model with further foundation work



04 Paint on the base colours

To begin texturing, we'll start simple and focus on small amounts of colour. One important thing to keep in mind is that later we will be using this Color map as a starting point for the Specular map. For this reason we'll need to keep a close eye on the values of the colour being used. With too much dark, those areas will be dull in the Specular map. Similarly, if the tones are too bright, those areas will be shiny in the Specular map. These are not inherently bad things, but it means that we need to be mindful of what surfaces we're painting on and what values of colour we're putting down. For the base colours, here we've chosen neutral yellows and browns, with a little bit of red for the palette. You can gradually add in tones using Blender's default Draw brush.

05 Add ambient occlusion To give a greater sense of depth to the texture, we'll bake the ambient occlusion and then multiply it against the texture. This can be done by adding a second Color layer from the Texture Paint Layers panel and then switching over to the Render Properties. Down at the bottom is the Bake panel, so change the Bake mode to Ambient Occlusion and then select Bake. This will bake the ambient occlusion to the currently assigned image map, which in this case is the new Color layer that was just added. It's also a good idea to enable Normalize, so that the AO isn't influenced by the active material. To multiply the AO against the texture, simply change the blending mode in the Texture Properties Influence panel to Multiply.



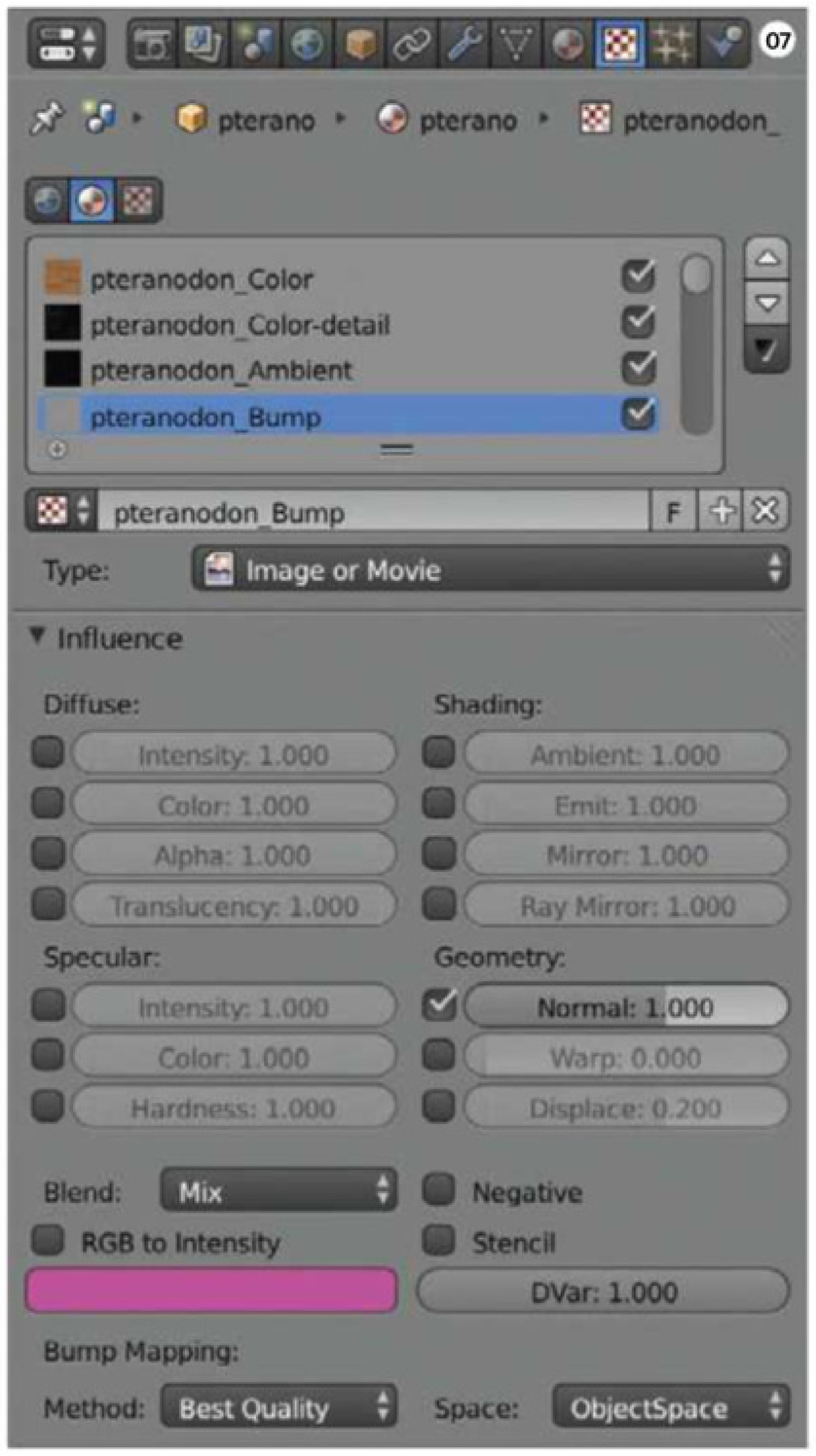
06 Include more texture detail We can now begin adding detail to the texture. The main aspects we'll add at this stage is colour variation with some skin patches. It's best to do this on a new layer, so start by adding a second Color layer and then paint on it by clicking the button by its name. At this stage it's ideal to use a brush texture, which makes it easier to get good variation. The texture we're using is a simple skin-like grunge patch made in Photoshop, which you can find supplied with this issue.

Make Bump maps

After the colour is satisfactory, it's time to produce more maps

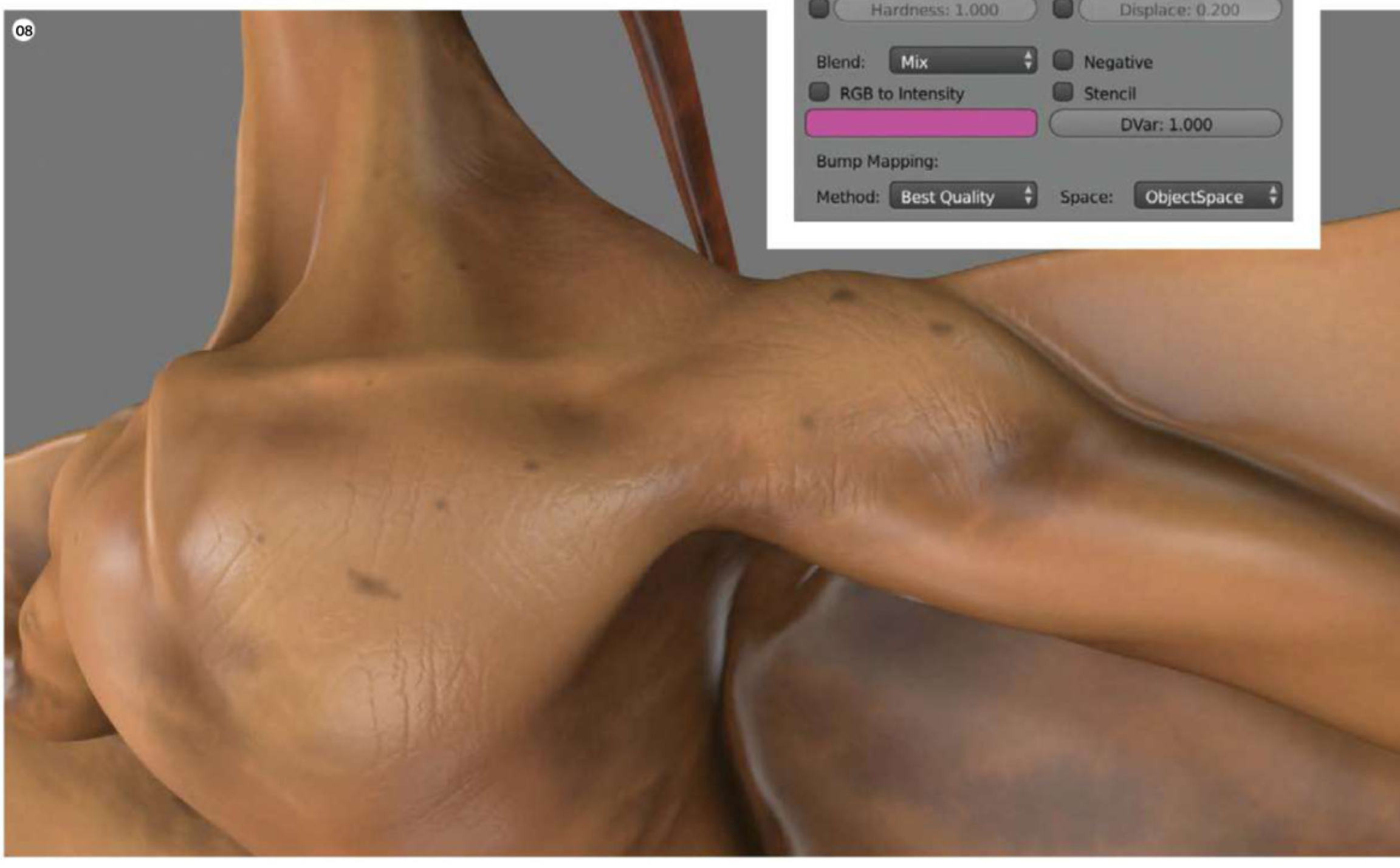
07 Apply a Bump layer With the Color map finally finished, we can now add the Bump layer. This can be done the same way as the other layers, this time pressing Add Bump, however, the default image assigned to the layer will be transparent, so instead we need to fill it with 50% grey. This can be completed manually with a brush or alternatively by loading the image into an external image editor, filling it, then reloading the image in Blender. Be sure the Bump image is 16-bit, or else the Bump-mapping process will produce severe artefacts that could cause major headaches at a later stage.

08 Paint skin wrinkles with a texture Now we can begin painting varying shades of black and white to raise or lower the Bump. In this case it's best to paint with a textured brush. Here we've chosen a photo of wrinkled elephant skin, as it has the depth and pattern that we're looking for (see below). To speed up the process over most of the model, try setting the Stroke Method to Space, with 40% Spacing. Also assign the Texture Angle to Random to enable you to draw over the surface and lay down a consistent, yet randomly aligned set of wrinkles.



Creating brush textures from photos

Making your own brush textures from photos is surprisingly easy and intuitive, particularly for creating Bump maps. To do this all you need is a photo with fairly even lighting, so there's no harsh highlights or shadows. Once you have that, desaturate and crop it square. You may also need to adjust the Levels or run it through a few filters to improve the overall results. Next, load the texture into Blender from the Brush Texture panel and Texture Properties. You can find my brush texture supplied with this issue, along with the original Creative Commons-licensed photo.

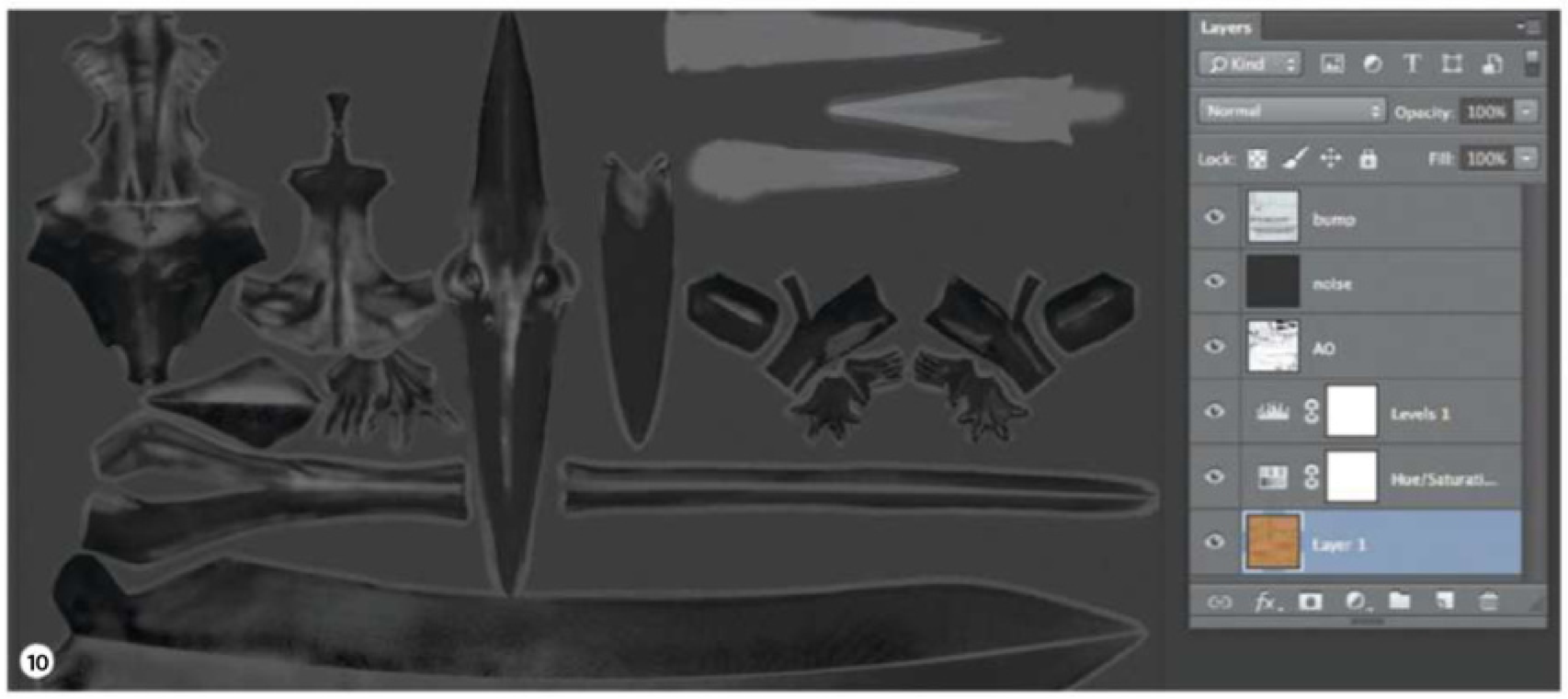


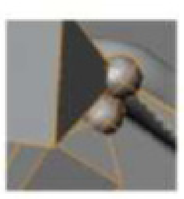
Start on the Specular map

After the Bump, we're ready to create the Spec map

09 Add the Specular layer As with the other layers, the Specular layer, which will control the shininess of the pteranodon's surface, is added by pressing Add Specular. After doing this, you should check that the settings are configured correctly for our purpose. First turn the material Specular Intensity to 0. All the specularity will be controlled via the texture. Next, on the texture, be sure Intensity is enabled and set to 1.0. You can adjust this to decrease the overall spec, but remember this material is configured for the Blender Render, simply for the viewport preview. Later on we'll switch to Cycles for the actual rendering. To finish, enable RGB To Intensity.

10 Generate the Spec map with Photoshop To create this map we'll combine and modify several of our existing maps in Photoshop. First we'll use the base Color map, then give it a Hue/Saturation and Levels adjustment. Using these we can desaturate the texture and bring the black levels in, leaving only the highlights. Next we'll layer on the AO at 5% Opacity with a Linear Dodge blending mode, then add a bit of noise with Filter>Noise>Add Noise. Do this on a new, black layer. Use Linear Dodge and a low opacity. Finally we can add in some of the detail by overlaying the Bump map. You may need to adjust the Levels of each layer.

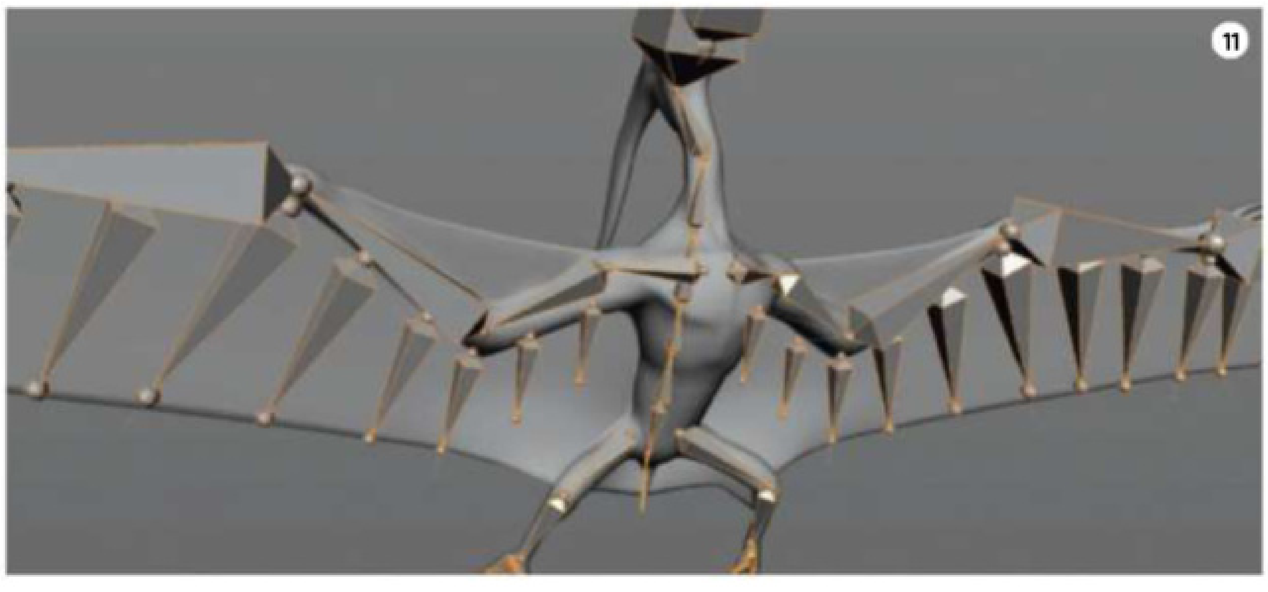




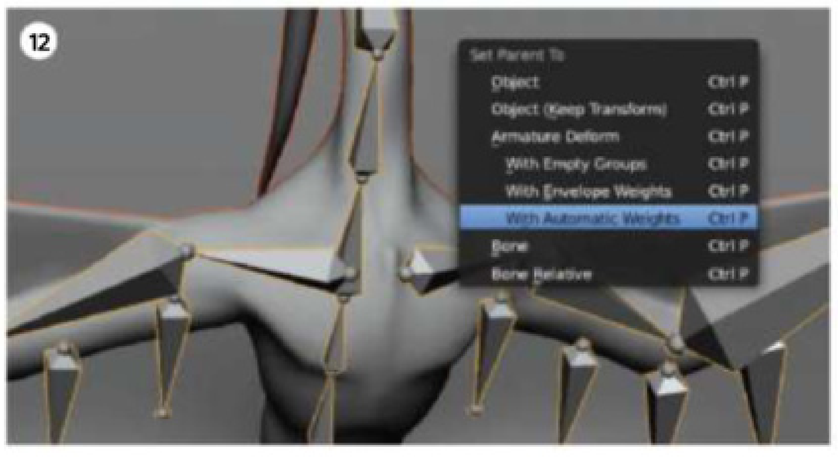
Start rigging

Now it's time to change tact and create a simple rig for posing

11 Create the base armature After the texturing is complete we need to move on to rigging. This is the part generally dreaded by artists, but it can be quite satisfying once complete. For this part of the tutorial, CG Cookie's own Kent Trammell stepped in and built the rig. The first step is to establish the base skeleton that makes up all the deforming bones. It's best to try to mimic the real skeletal structure here. You can add an armature via the 3D Viewport, Shift+A>Armature>Single Bone. From the first bone it's just a matter of extruding, duplicating and positioning each of the other bones.

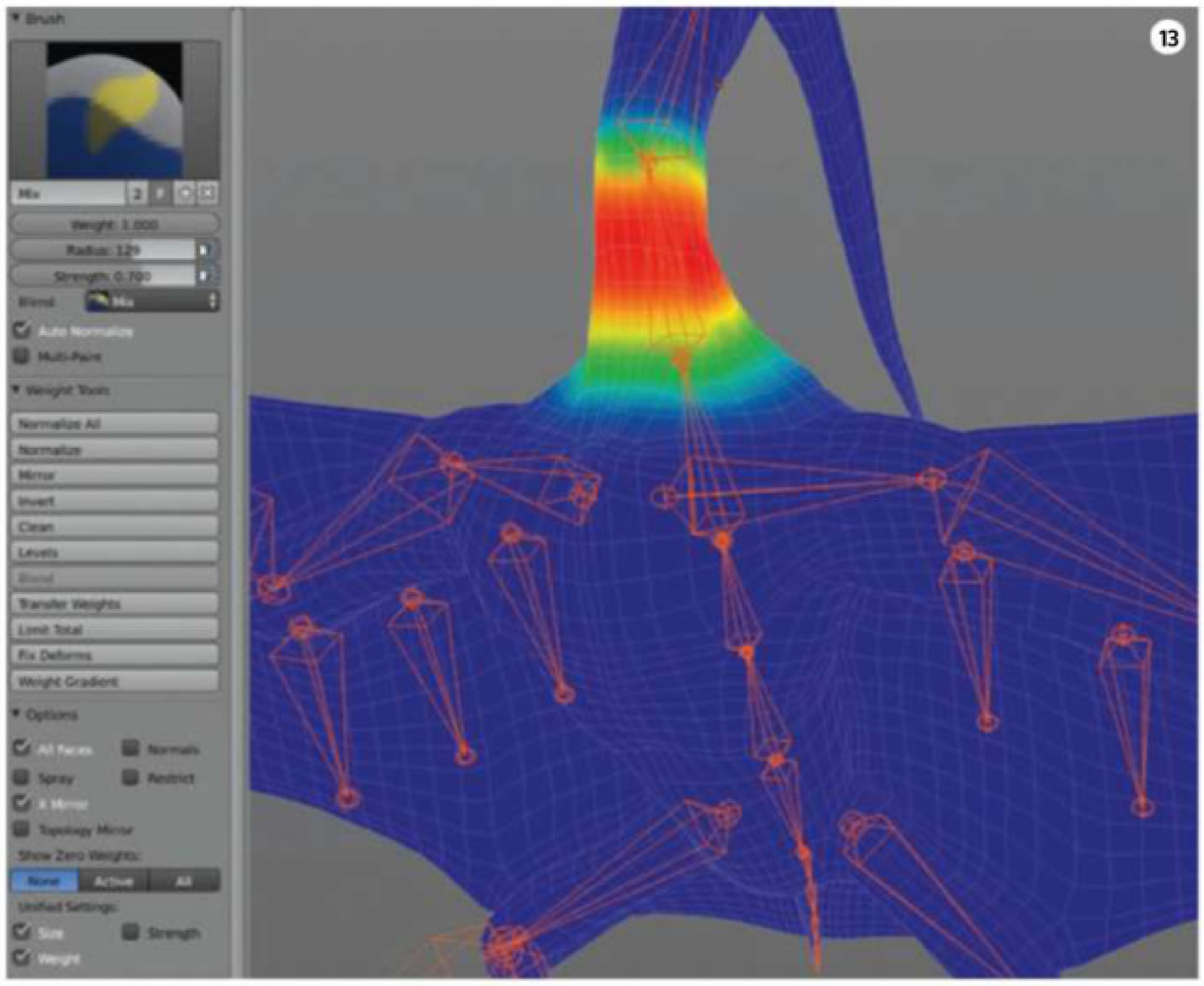


12 Assign the armature modifier Once the base rig is built, we can ago ahead and assign the mesh to it, enabling us to begin moving things around. To assign the mesh to the rig, first switch to Object Mode, select the pteranodon object, then hold Shift and select the armature. Next hit Cmd/Ctrl+P and choose Set Parent To>With Automatic Weights. This will automatically create a vertex group for each bone and set the weights as best it can. Switching the armature in Pose mode now enables you to pose the model, but most likely the weight-painting will need to be adjusted.



13 Begin weight-painting the mesh

Although the automatic weight assignment works quite well a lot of the time, there are generally many improvements that can be made, particularly on a model like this with a lot of bones. To adjust the weights on any bone, first set the armature to Pose mode, then select the pteranodon mesh and switch to Weight Paint mode. Now you can select any bone and immediately see the weights of the vertices assigned to it. Using the brush tools you can now add, subtract, mix, or otherwise alter the weights by painting. Weight-painting is a very tedious process, but just stick with it and it'll be all worth it in the end.

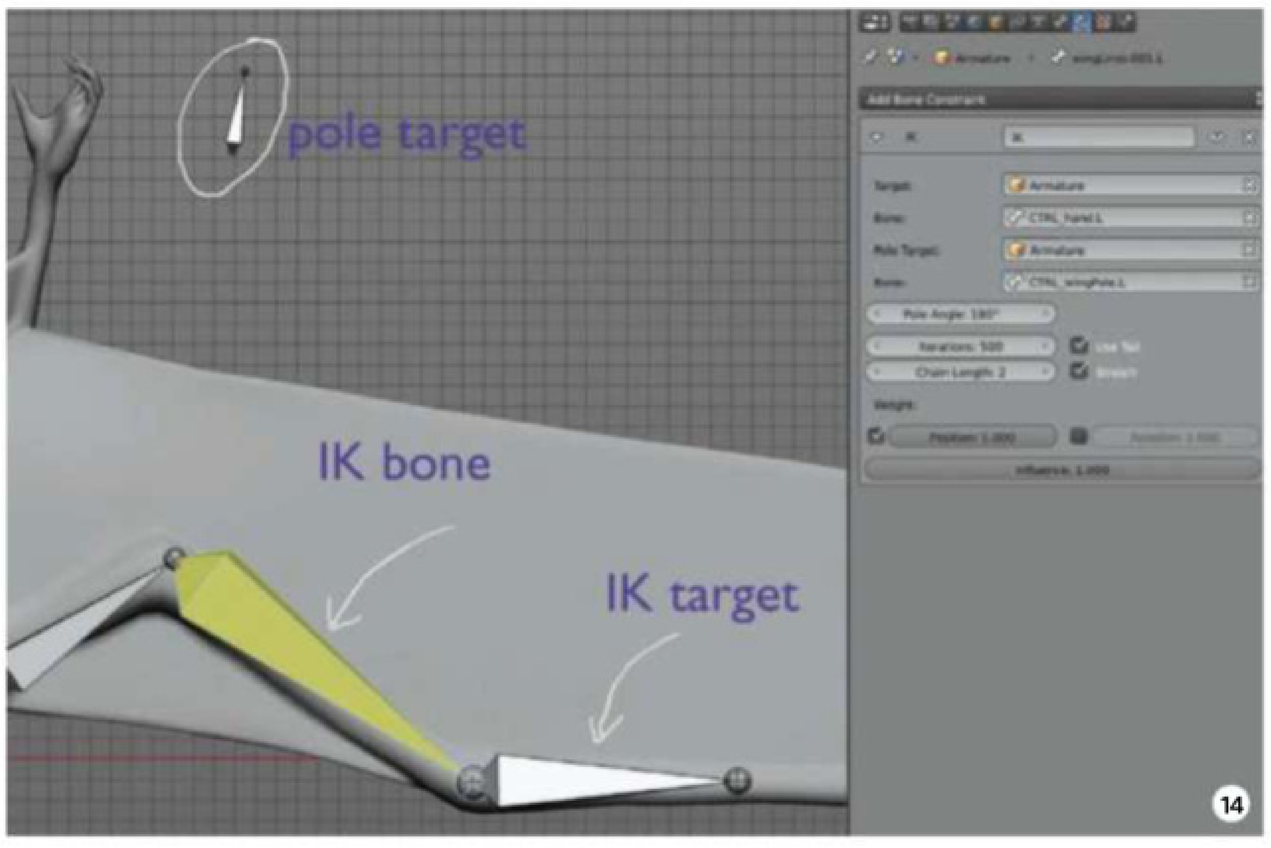


Posing the pteranodon

The rig we've built for the pteranodon is relatively basic, making it suitable for simple animation and posing. In the case of this dinosaur, the rig is intended for establishing the final pose, so we can push the pose further without worrying too much about the rig breaking. Any rough points in the deformation can be fixed with corrective sculpting once the final pose has been decided. Corrective sculpting can also be used to add in additional deformation detail that otherwise would be difficult to achieve with weight-painting alone.

14 Add IK constraints for increased control

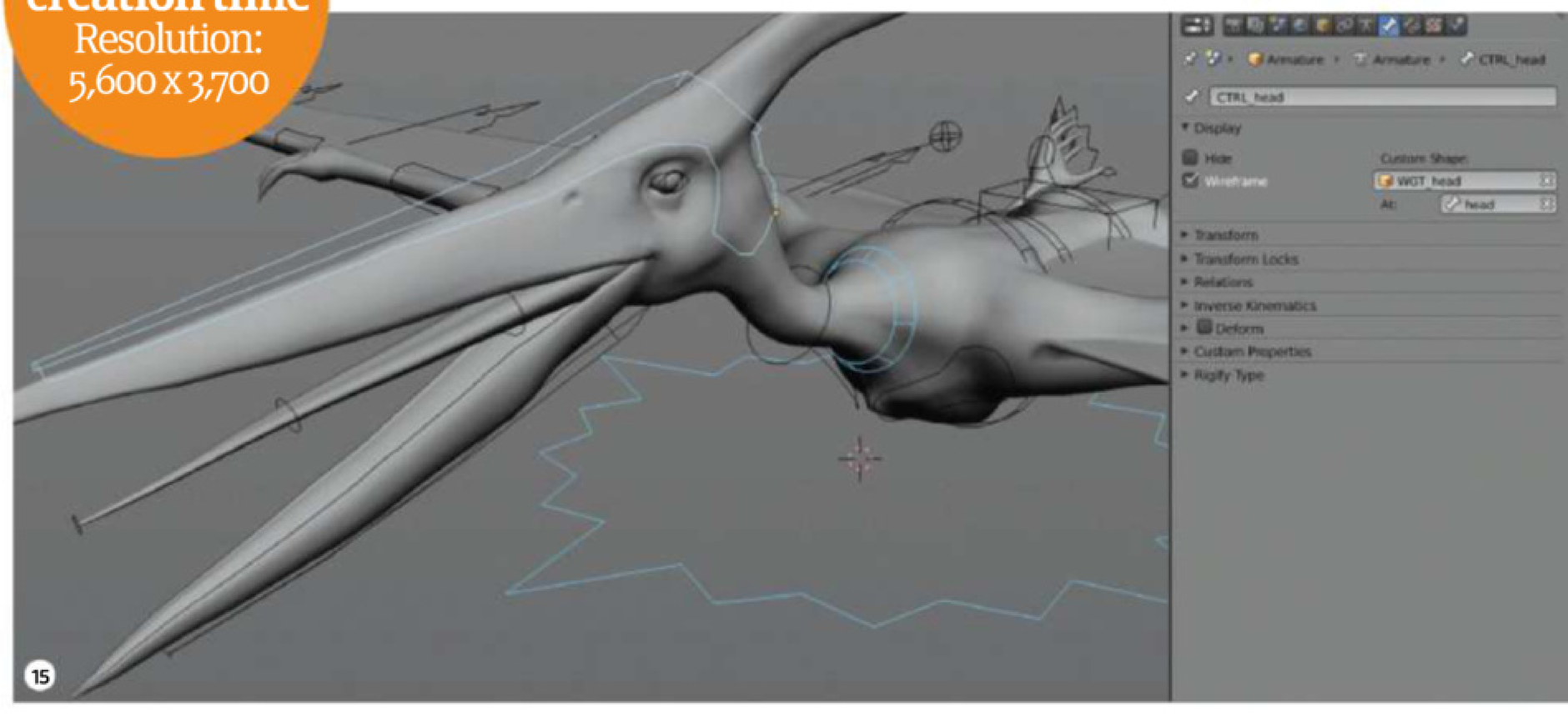
Currently the rig is perfectly moveable, but it's not very user-friendly. To improve the experience we can add a series of constraints to the bones. In the final rig, we've used a series of IK, Copy Rotation and Stretch To constraints. If you're not sure on these, study the BLEND file supplied. For now, let's look at adding an IK, or Inverse Kinematic, constraint. This constraint needs a minimum of two bones – the actual IK bone that will receive the constraint and an IK target bone. The target bone must be disconnected from the IK bone. Additionally you can add a third pole target bone for greater control. After adding and configuring the constraint, you can move the whole chain with just the IK target bone. Using IKs for the wing, feet and head enables easy posing by moving just a few bones.



15 Make custom bone shapes

In addition to the constraints, another way we can improve the user experience for the rig is by adding custom bone shapes, which are made from meshes and then assigned to specific bones via the Bone Properties while that bone is selected. Shapes can be as simple or elaborate as you choose, but ideally they should convey their purpose in some way. In order to place the bone shapes, be sure the shape mesh is orientated nicely with its origin. The origin is placed at the root of the bone so it determines the orientation. Next issue we'll look at creating the shaders, lighting and rendering for the final composition.

25 hours creation time
Resolution: 5,600 x 3,700



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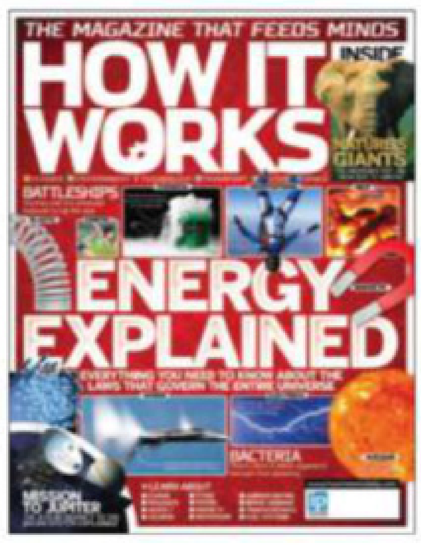

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Masterclass

Chévon Leo is a 21-year-old freelancer from Cape Town, South Africa. He specialises in creating believable facial expressions

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Tutorial files:
On the disc you'll find all of Chévon's tutorial screenshots, as well as the final ZTL file

Final render of the sculpted character

Sculpt intense facial expressions

"Chévon Leo describes his process for building highly emotive facial expressions in ZBrush"

Without expression, characters run the risk of becoming boring. Giving them a good expression is vital, as it portrays personality and brings them to life. Throughout these steps I will be demonstrating my own process for sculpting a character, focusing mainly on giving him a believable, yet characterised, facial expression using the optimal tools in ZBrush.

Expressions play a huge role in everyday life. When we look at somebody, we can immediately tell what kind of mood they are in. We are even able to get a lot of information about people without ever having to speak to them. This is made possible by our natural ability to recognise human expressions.

When sculpting expressions, believability is imperative. One of the first steps to a believable expression is to look at the face as a single object. What do I mean by that? Grab a mirror, follow this little experiment and things should become a lot clearer.

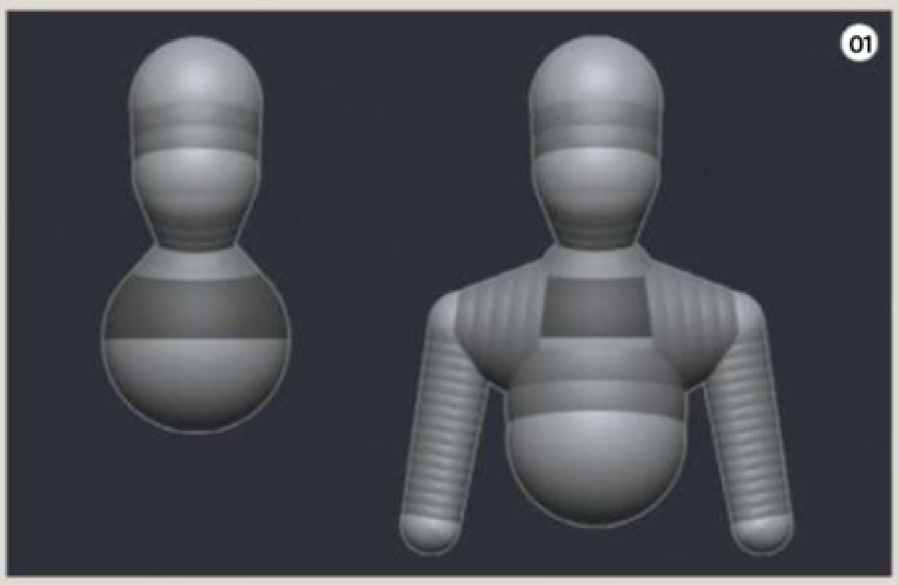
Look at yourself in the mirror and try to keep a neutral expression. Now smile. Switch between the two expressions and observe the changes that are occurring. Notice that it's not only the mouth and its immediate surrounding areas that are affected, but there are changes happening across the entire face. For example, your nasolabial fold or laughing lines are more defined, your nostrils have widened, your eyes have narrowed and your ears have even moved up slightly.

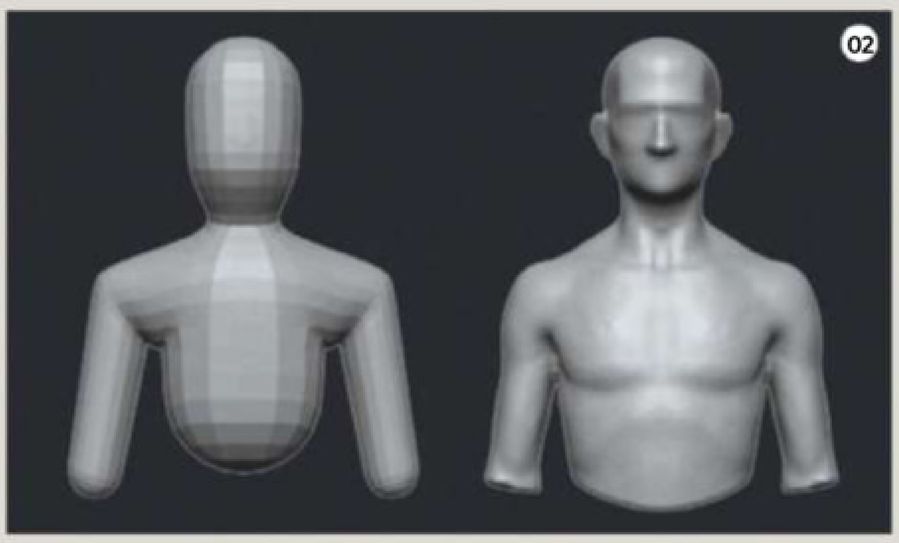
Due to this observation, it's safe to say that conveying expression in your artwork can be a fairly complex task. In order to simplify things, we need to break the face down into individual areas, while still remembering to observe all the changes in the face as a whole. Keep your mirror close by and grab a sheet of paper. While smiling, cover the lower half of your face. You're still able to identify the expression, right? So, nailing the subtle changes and details in all individual areas of the face is key to producing a successful expression.

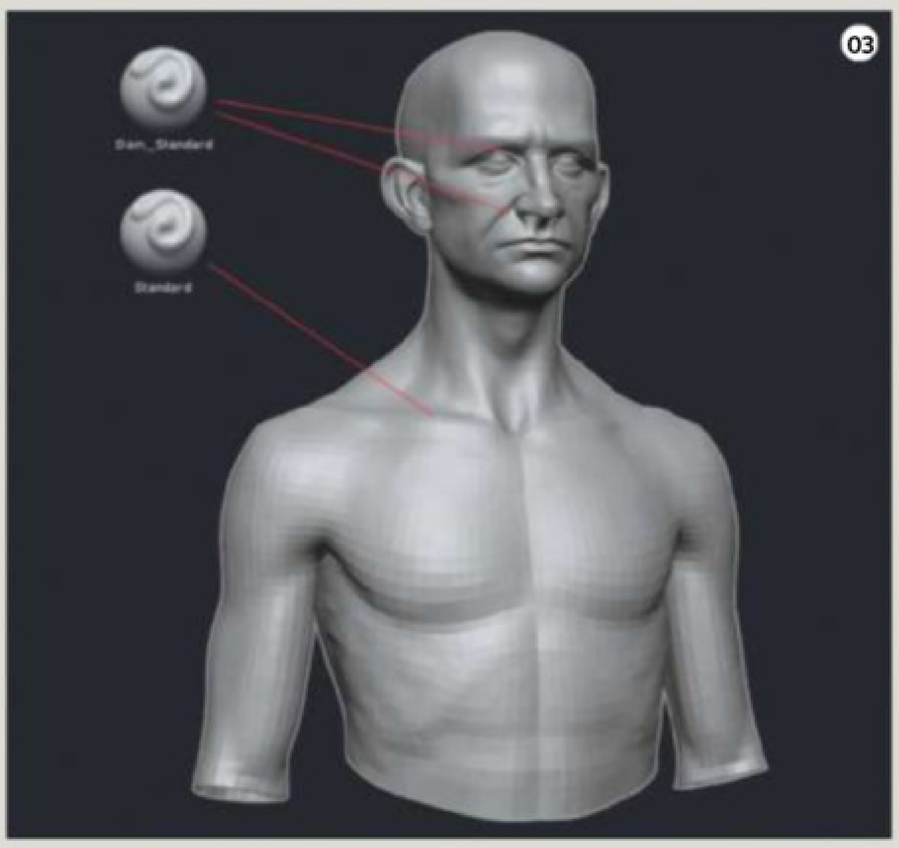
Here we will be creating the character/bust from scratch, using ZSpheres to start on our base mesh. We will then give the character an identity, pose him and spend a lot of focus on the eye and mouth areas of the facial expression.

The final steps will be focused on refining the model and adding supporting wrinkles, folds and hair to further enhance the personality and final look of the character. We will then export our character to Maya and render him using V-Ray.

This process shows the approach I have found is best suited to my projects' needs, however, it is by no means the only way to achieve the same result. I believe that, as an artist, you have to find the workflow that best suits *your* needs. I hope these tips point you towards some great results.







Give your character sculpt some personality

01 Start with ZSpheres

ZSpheres can be used to create the basic structure of the character. While this is not the only way to go about it, I prefer using them because they provide a quick and flexible way of building a custom, unique base mesh. When working with ZSpheres, I set the Draw Size to 1, as this makes it easier to manipulate them without affecting any adjacent ZSpheres. I start by making a neck and head from the base sphere, and also create a shape that represents the chest. I then continue by adding the torso and arms. Once I am happy with the structure of my ZSpheres, I navigate to the Tool palette and click Make Adaptive Skin.

02 Form and proportion

Once the base mesh is complete, the next step is to capture the general form and proportions of the character. Proportions play a vital role in the believability of a character and their expressions. Whether you're working on a photoreal or a stylised character, your proportions need to be appealing to the eye. Having an amazing expression and detail means nothing if your proportions are wrong, so spend some time on this important step. Enable DynaMesh at a Resolution of 64, then tweak the proportions using the Move brush, all the while adding and subtracting volume with the Clay Tubes brush. When constructing forms, identify the bony landmarks on the body and use them as a guide.

03 Refine the forms

Now that we have our general form set in stone, we are able to increase the resolution and get to work on refining the character to give him a unique identity. Use the Standard brush to define areas where bone and cartilage protrude, as well as the Dam Standard brush for creating creases/folds and the Clay Tubes brush, with a low Intensity (3-6), for volumes. During this stage, focus on the planes and structure of the face. Don't go into too much detail here, as we'll get to this in a later stage, once our character has been posed. It's a good idea to retopologise your mesh now, as it makes posing easier and more efficient later on.

Anatomy

In order to achieve a believable humanoid character, complete with good expression and personality, it's beneficial to have some understanding of basic human anatomy. When solely relying on reference, without any basic understanding, you could easily fall into the trap of thinking your anatomy is correct, when it could perhaps be slightly faulty. You don't necessarily need to devote your life to understanding every bone and muscle in the body, but understanding the forms and planes that these bones and muscles create can be key to a believable sculpt. I encourage you to do some research on the subject as it will help you a great deal on all further projects. There are many fantastic books available on the subject, one of my favourites being *Artistic Anatomy* by Dr. Paul Richer.

04

04 Capture good reference

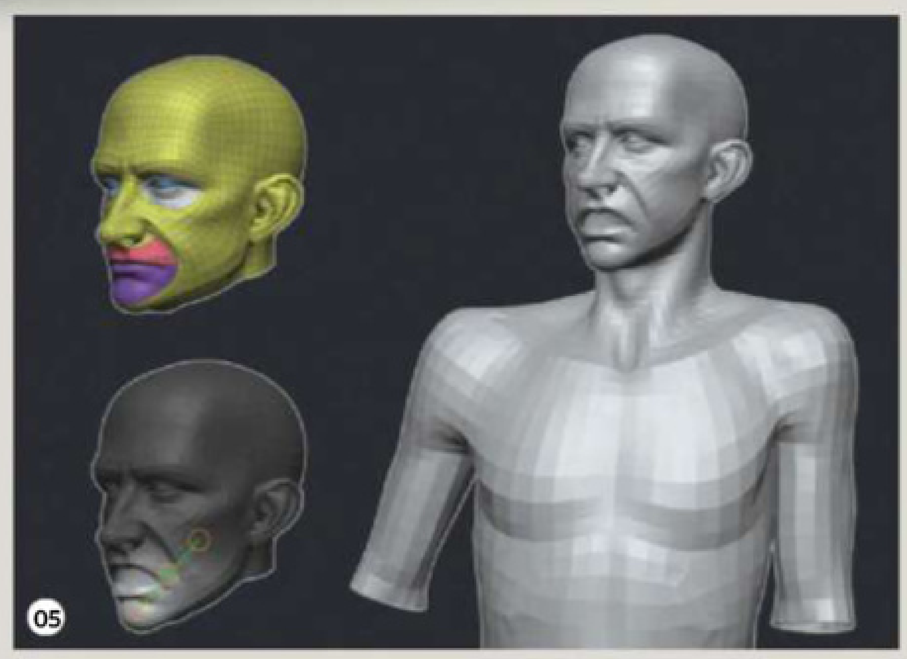
Reference plays a vital role in the sculpting process and with the invention of the internet and Google, it's just a mouse-click or two away. However, because we have something very specific in mind in terms of expression, a trusty old camera and a helpful model to pose for you is more useful. Another way to obtain reference is by observing yourself. Keep a mirror at your workstation and constantly use it to analyse the creases, wrinkles and tension areas that form expression. It may feel weird at first, but it's one of the quickest and most convenient ways to obtain reference.

05 Establish the pose

Body language is important when portraying emotion. As such, it's beneficial to give the character a captivating pose. At this point in the creation process you can turn off Symmetry. When posing a character, drop down to the lowest subdivision available, then isolate and mask the polygroups of the parts that you need to pose. Once you've properly masked the required body part, invert it and reveal the rest of the body. You can then proceed to manipulate the part into the desired position using the Transpose tools. During this process, be sure to observe the silhouette of the model from all angles by hitting the V key on your keyboard. This switches to your secondary colour, which is black by default.

06 Block out the expression

Now that the pose is properly established, use the Move brush in conjunction with the Smooth brush to repair any errors that may have occurred during the posing phase. Next, begin loosely blocking out the major influence areas of the expression, such as the brows and general shape of the mouth.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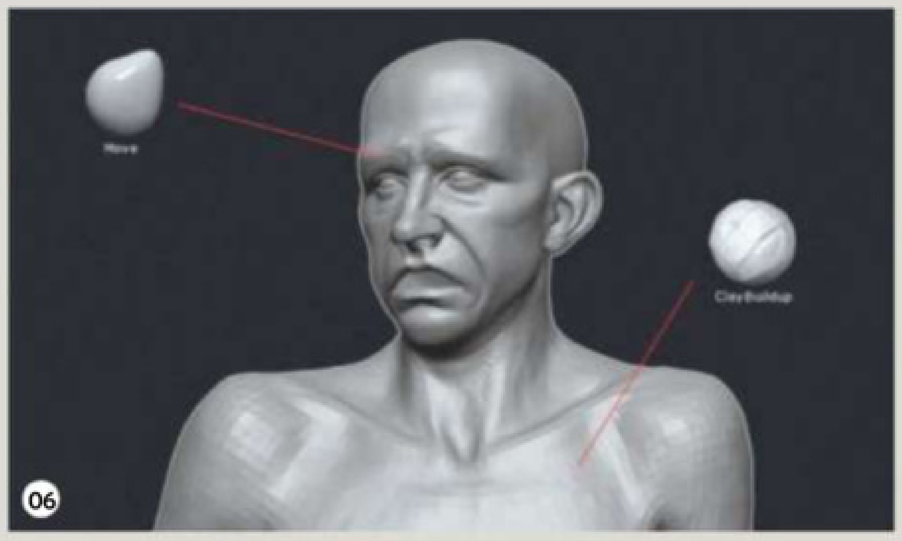

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Workflow efficiency

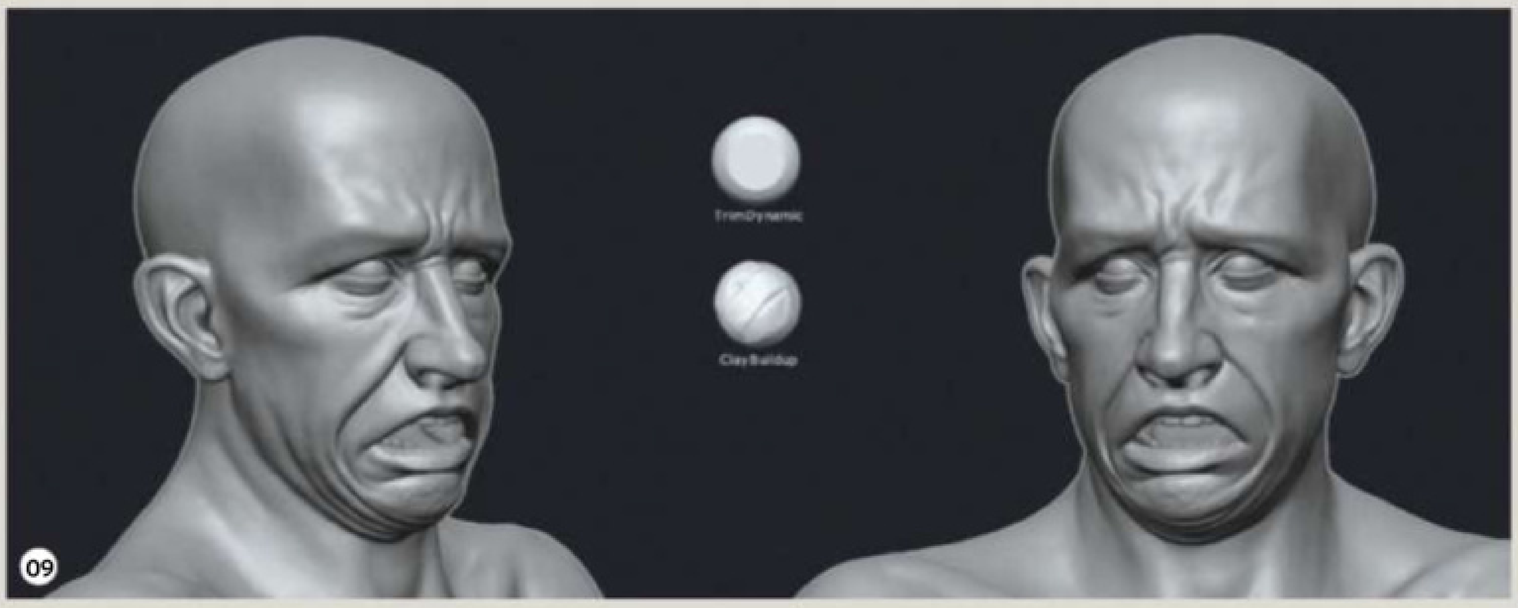
ZBrush is fully customisable and enables you to create a shortcut for almost all commands offered. To apply custom shortcuts, hold Cmd/Ctrl+Opt/Alt and click on the function you wish to create a shortcut for, followed by the key you want to allocate to the shortcut. I use shortcuts for everything from brushes to creating polygroups. Try to create shortcuts for the tools used most in your workflow. Another efficiency tip is to store a morph target before sculpting and utilise the Morph brush as an eraser, rather than the Undo command, as it can become sluggish when working on dense meshes.

07 Sculpt the eyes and nose

As mentioned earlier, we will be isolating areas of the face while working on the expression. This is to ensure we get as much emotion in the eye region as possible, without being distracted by the rest of the face. If we are able to properly capture the details of the expression in each isolated area, the overall expression should be easily readable. I rely mainly on the Move brush to shape the expression. It's best to tweak the brow areas, raise the lower eyelids and focus on the areas directly around the eyeballs. Even the areas under the eyes need to be given some form and definition. It's also important to focus on the area between the eyebrows, known as the glabella, to ensure that the skin is folding – or not, as the case may be – as it would in real life. If you want to convey extreme detail, then focus on all areas of the nose, including the supra-alar crease, alar-sidewall, columella and nostrils, ensuring all these different parts of the nose are reacting to the changes in the face.

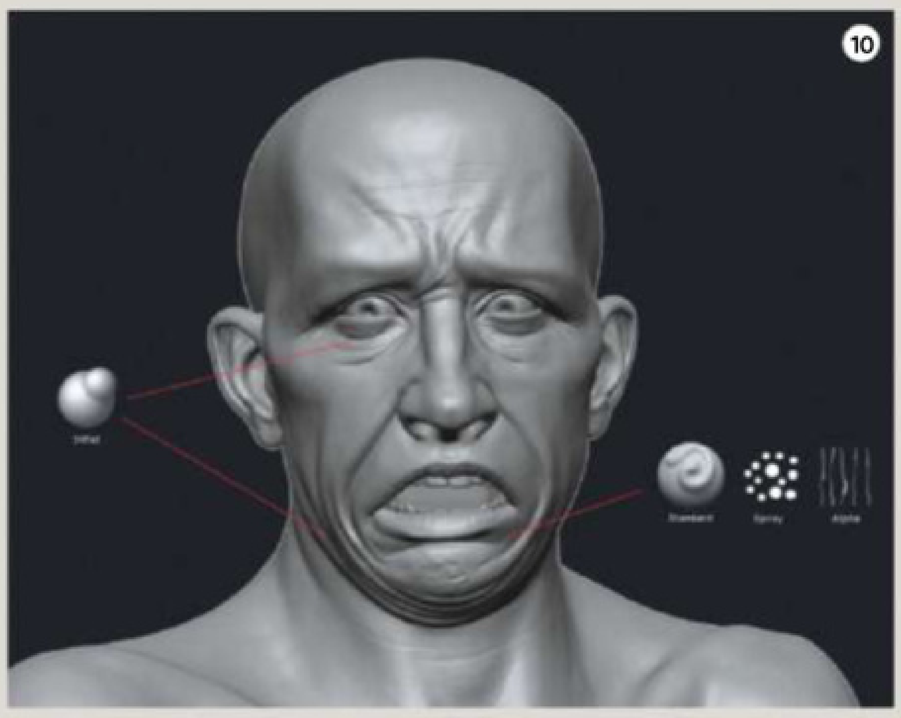
08 Build up the mouth

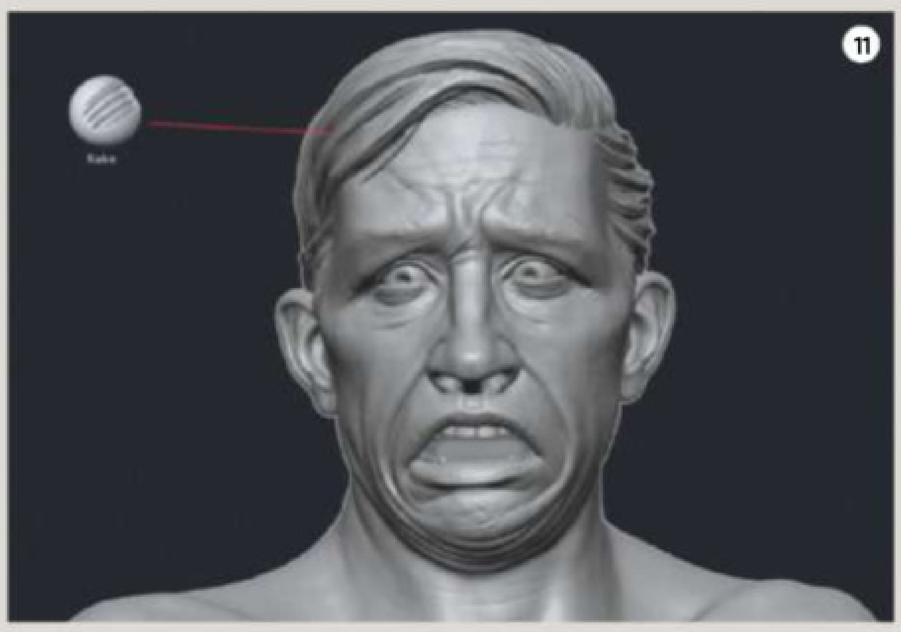
The Move Topological brush is useful for morphing the mouth into the desired shape, which affects the mesh based on the topology, rather than the overall area. This lets us manipulate the lower lip without affecting the upper lip. Remember, you should be continuously looking in the mirror as a source of reference. By using this reference, you'll see what the character is lacking, such as some volume in the lips. To correct this, add volume using the Inflate brush. When sculpting the mouth, focus on the bottom half of the face as if it were a single object. Look at the tip of the nose, the chin and the nasolabial folds. It's vital to correctly capture these areas, as they portray tension in the muscles. Pay particular attention to the corners of the mouth and the shape of the lips.

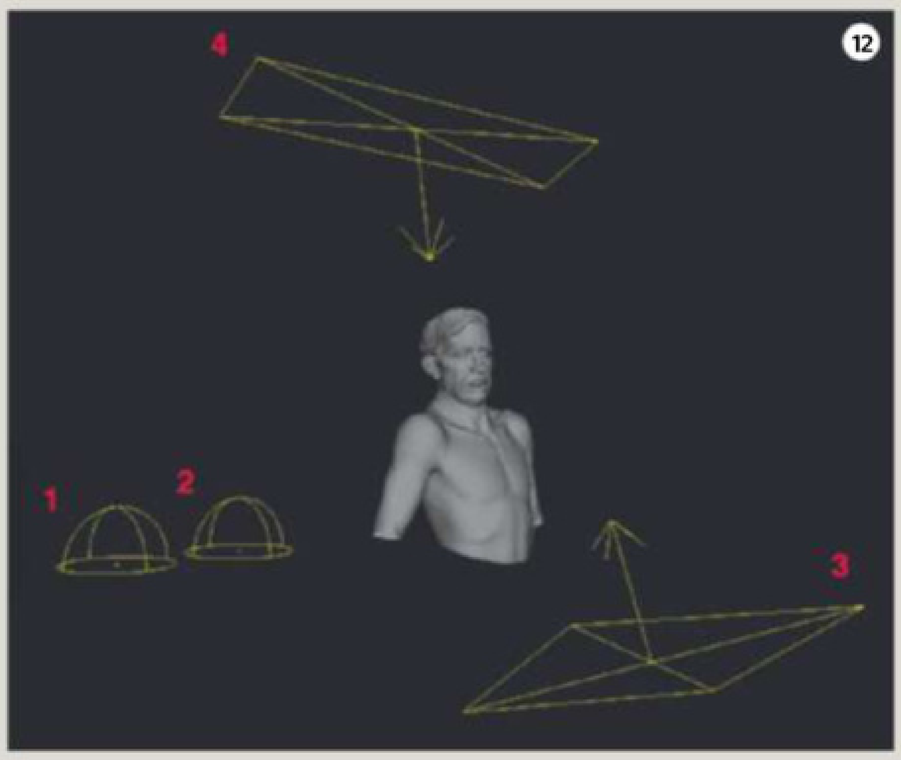


09 Polish things up

In order to polish the model, increase the subdivision level and use the Trim Dynamic brush, as opposed to the Smooth brush, which is far too destructive on the forms we have spent so much time creating. It's at this stage that we can also look at the expression as a whole and focus on getting all of the elements to work well with one another. Any changes we make at this stage should be incredibly subtle. To view the before and after meshes, first store a morph target before sculpting. Then, by clicking the Switch button in the Morph palette, you can view all the changes made and review their merit.







The clay material

When creating the material, I opted for a simplistic approach. I created a VRayMtl, setting the Reflection to white, decreasing the Glossiness and enabling Fresnel Reflections. Fresnel uses the viewing angle to determine the amount of reflection that occurs on any given material. This mimics real-life reflection behaviour – if you would like more information on this, I encourage you to search for BRDF online. For my specific material, I wanted it to resemble clay, so, I plugged a fingerprint texture created by Jeff Patton in as a Bump map. I played around with the Intensity until I found something that I was satisfied with. Because I hadn't created any UVs for my character, I applied the texture as a projection based on my render camera.

10 Add wrinkles and folds

By utilising ZBrush's layer system to maintain control over the Intensity, you can start adding supporting wrinkles to the face. Begin with the larger folds, such as those below the chin, using the Dam Standard brush with a large Draw size and a small Focal Shift to give a more gradual, less harsh crease. To give the feel of compression, gently go over the creases with the Inflate brush. Add finer wrinkles and details wherever you deem necessary. While there are many Alphas available on the internet, ZBrush's default set of Alphas is more than sufficient. Use the Standard brush with the Alpha set to 58, as well as a Radial Blur and Spray Stroke to apply finer details. Play with various Alphas, as they can produce some interesting results.

11 Make some tweaks

Before exporting the character to your external 3D package of choice, assess the model, make subtle changes where necessary and start work on the hair. Begin by creating an additional layer and blocking out clumps of hair with the Clay Tubes brush. Refine the hair using a low-intensity Rake brush, which mimics strands of hair. Both these brushes are used in conjunction with the Lazy Mouse to create clean strokes. Obviously hair does not react to expression, but a furrowed or straightened brow can move the hairline. As for the eyebrows, I created a custom Alpha and applied it with the Standard brush and the Drag Direction stroke.

12 Set up the render

We're now ready to bring our character to life. To provide the scene with some ambience, create two V-Ray Dome Lights. Light 1 affects the Diffuse attribute, while Light 2 affects the Reflection. This provides us with additional control over the final render, as we're able to tweak the Reflection and Diffuse amounts separately. Lighting is important when creating expression, as it will ultimately add more definition to the character and the details you have created. Accompanying the V-Ray Dome Lights are three V-Ray Rectangular Lights. Light 3 is the key light and Light 4 is the rim light. To calculate GI, use an unbiased solution by setting both the Primary and Secondary Bounce to Brute Force. Please note that this will increase your render time significantly, but in my experience it produces the most accurate results. By default, V-Ray also produces too much GI, so lower the Bounce values to around 0.65. The final image is rendered out at 3,000 x 1,800 pixels as a 32-bit OpenEXR.

• **DID YOU KNOW?** • All tutorial files can also be downloaded from: **www.3dartistonline.com/files**

3DArtist

Back to basics

Jahirul Amin talks you through the creation of a Metropolitan Railway Class-A locomotive

The final model rendered in KeyShot

With the Disc

Tutorial files:

- A Maya project directory ('project_loco') with all the scene files has been included
- 'locoReference_photos': a folder that consists of photos and videos to help support the modelling process

Model a steam locomotive in Maya

"Learn how to take simple shapes and refine them to create a vintage steam locomotive"

In this three-part series we will be travelling back to the age of steam as we model, rig and animate a steam locomotive. This issue we will focus on modelling the Number 23, a Metropolitan Railway Class-A steam locomotive from the 1860s, one of which has been preserved at the London Transport Museum in the UK.

Studying images on the web highlighted the design complexity of the locomotive. So, to be faithful to this iconic beast, I thought it best to travel down to London and capture as much reference as possible to aid me during the modelling process. All the reference shots I took are supplied with this issue. Once the modelling process began, it quickly became very clear that I'd have been lost without this reference in trying to digitally reassemble such a complex machine. Going through the images, you'll notice how truly hand-made the locomotive looks. All these steam trains have stories to tell – tales from their manufacture and their use – and each rivet and bolt lays testament to these stories. For me, this is the appeal of modelling a machine of the past – it has a character and class that I must seek to do some justice to.

Looking through the images, you will also see that there are numerous customised parts that will need to be built. I've tried as much as possible to reuse or rework parts to speed up the creation process, but anything I have reworked, I've tried to add some variation to in order to honour the fact that this locomotive was created by hands, not machines. I would advise making constant reference to images I've supplied, or any additional images you manage to locate, as this will be the key to a successful model. However, do please note that, due to the fact that the Number 23 at the London Transport Museum is positioned partly underground, I couldn't photograph it in its entirety. This means I've had to use online images of other contemporary trains to model some of the lower elements.

If you're interested, it's worth looking online at the construction process of machines like this. As well as making you pretty awestruck at the manufacturing achievement here, the images should also help inform your decision-making during the modelling phase.

As far as the process I followed with this project goes, there's really nothing complicated about the elements that have to be modelled here. What you essentially have are cylinders and cubes that need to be shaped and customised to provide the aforementioned individuality. The difficulty comes in the assembly process, as there are simply so many parts. On occasion this could make it feel like you're doing a 2,000-piece jigsaw of a blizzard, which can

get a little overwhelming. The other point worth mentioning is that the majority of the shapes used here will need to be bevelled so that their form can be revealed when light hits them later on.

In order to provide the basic proportions of the train for the modelling process, I sketched its shape to use as the starting image. A sketch was the only option, as there was nothing suitable online and the whole train couldn't be photographed.

As you model it's important to always bear in mind that we'll be looking to rig the train in subsequent tutorials. Consequently, you'll need to think mechanically, especially when building parts such as the piston and the crankshaft. As I was modelling, I created a quick piston-esque rig to test whether the proportions worked. It may prove necessary in the rigging stage to adjust the model slightly, but some simple tests during the modelling process will act as damage limitation.

Before we go to the steps, I'd like to point out that my youth was not misspent train-spotting, but rather misspent pausing videos and tracing over Disney characters on the screen. Therefore, if there are any mistakes in terminology or mechanics that are glaring to any steam enthusiasts out there, my apologies.

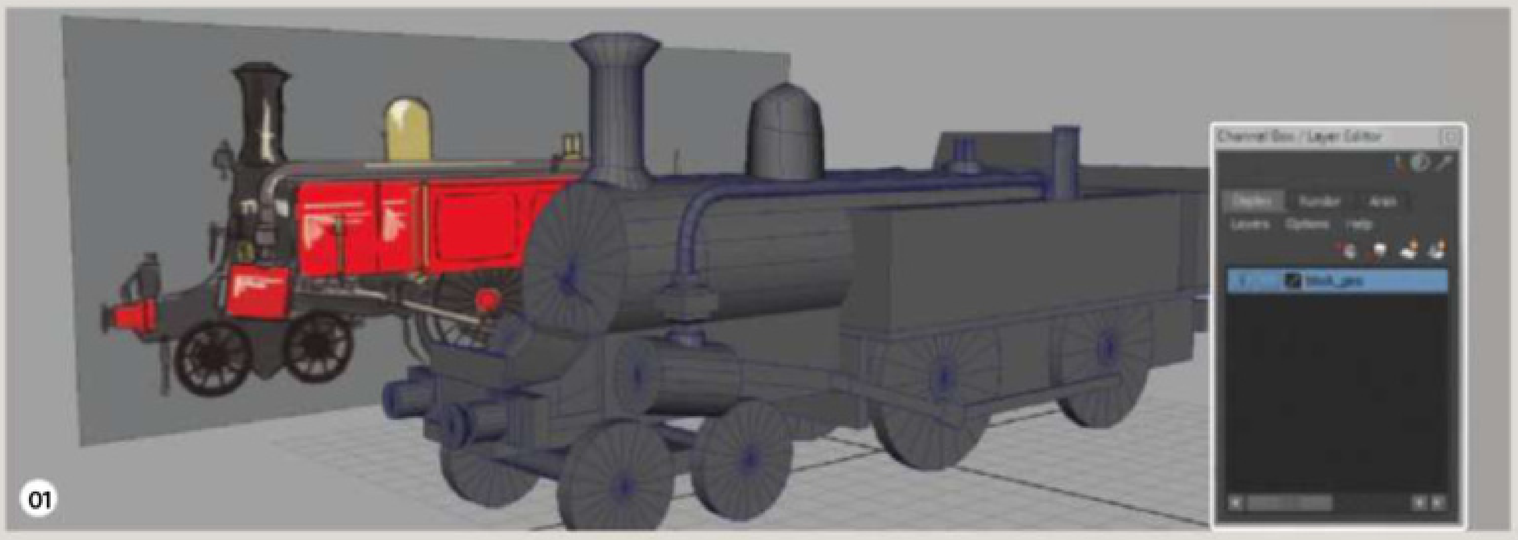
The rear side of the Number 23 locomotive

Some of the reference images used throughout the tutorial

Stay on track with ten steps

01 Reference and blocking

The first thing you'll want to do is bring in a reference sketch to help set up the general proportions of the locomotive. In the Viewport menu for the Side view, go to View>Image Plane>Import Image. When the Open screen pops up, select 'trainRef_side.jpg'. With the image plane selected, go to the Attribute Editor and use the Center attributes to position the image so the wheels sit on the ground plane and translate the image in the X-axis so you have space to work on the grid. I'm using Maya 2012, but If you are using 2013 or above, you should be able to use the Translate tool to move the position of the image plane. Next, use basic shapes to block out the major shapes, making sure to check how they come together from all angles. Here I've used a combination of cylinders and cubes to block out the model. Once you're happy with the blocking, pop all the geometry into a layer and name this 'block_geo'.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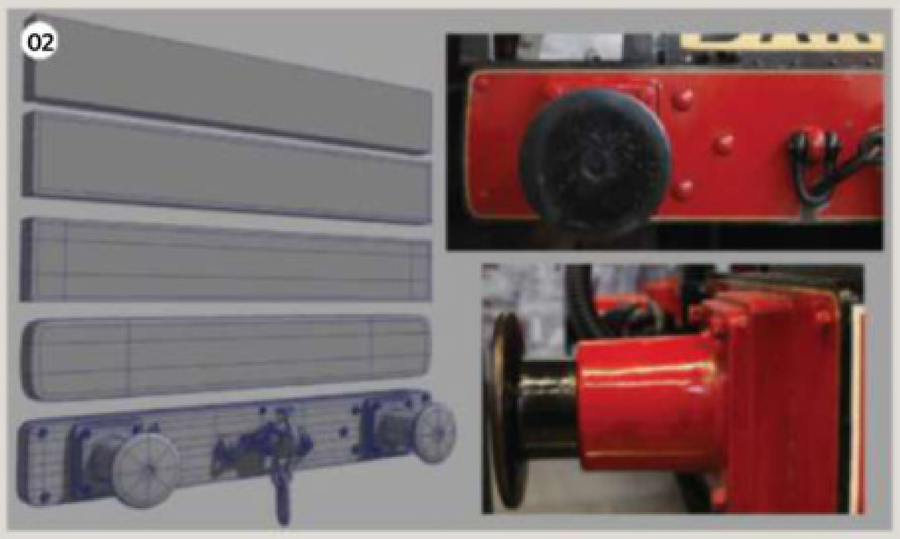
02 Work on the front

Next, start to refine the area at the front of the locomotive: the buffer and the coupler. Starting with a basic cube, begin to create the main area to which the buffer will attach. Select the front and back face and go to Edit Mesh>Extrude. Use the manipulator to scale the faces inwards and then use the Insert Edge Loop tool to create a nice tight edge that runs around the cube. Refine the mesh while adding further edge loops and be sure to always refer back to the reference images. It's worth examining how the light falls on the locomotive and trying to replicate that within the model. Next you can work on adding the coupler and chain links, using simple Torus primitives, to give the front its distinct character.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Back to basics

03 Add headlights

For the headlight, break down the reference, noting how the object is made up of many individual plates held together by links. With simple cubes, use the Bevel tool with the Segments set to 2 so you can stick to quads. By duplicating this object you can create all the sides of the headlight. Next, make a cylinder, setting the Subdivision Axis to 8 in the Channel Box to keep the mesh light. On the top and bottom of the cylinder, select every other edge and delete them to give you all quads again. Follow this by adding two edge loops running around the cylinder, one at the top and one at the bottom along the height. This is how we'll create all the cylindrical objects for this model. With the cylinder edited, wrap it around the headlight to match the reference. Build up the remaining parts of the headlight by taking basic primitives and refining them.

04 Finish the front

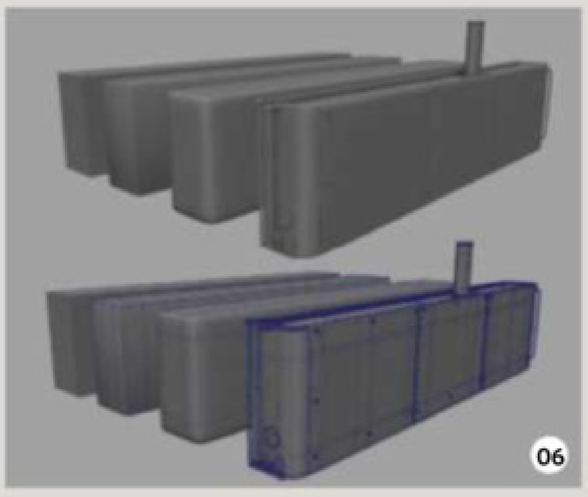
Continue to work on the front of the train by adding the sign, the metal framing and the smoke box door. Again, all these elements can start from the humble cylinder and cube, then refined to match the reference, making sure to pay careful attention to the uniqueness of each part. To add bolts, make spheres, reduce the subdivisions and then flatten them slightly using the Scale tool. These have been positioned throughout the entire locomotive and the majority of them can be placed slightly out of alignment for greater authenticity.

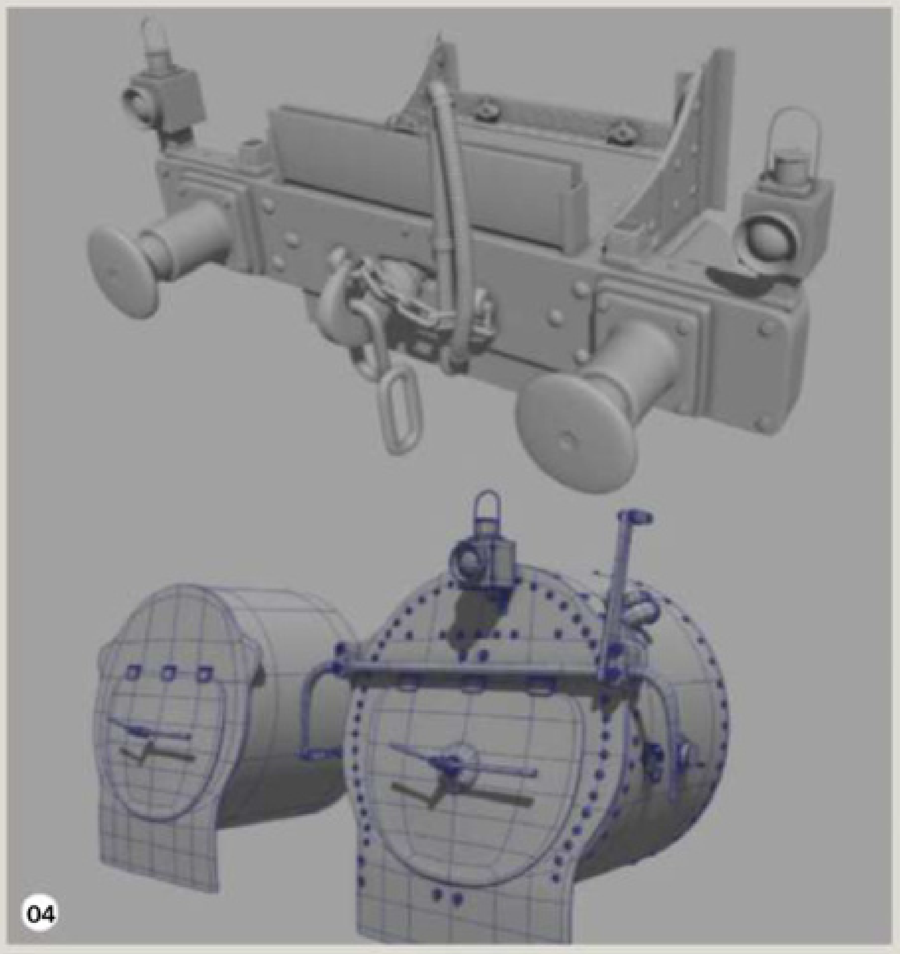
05 The boiler and chimney

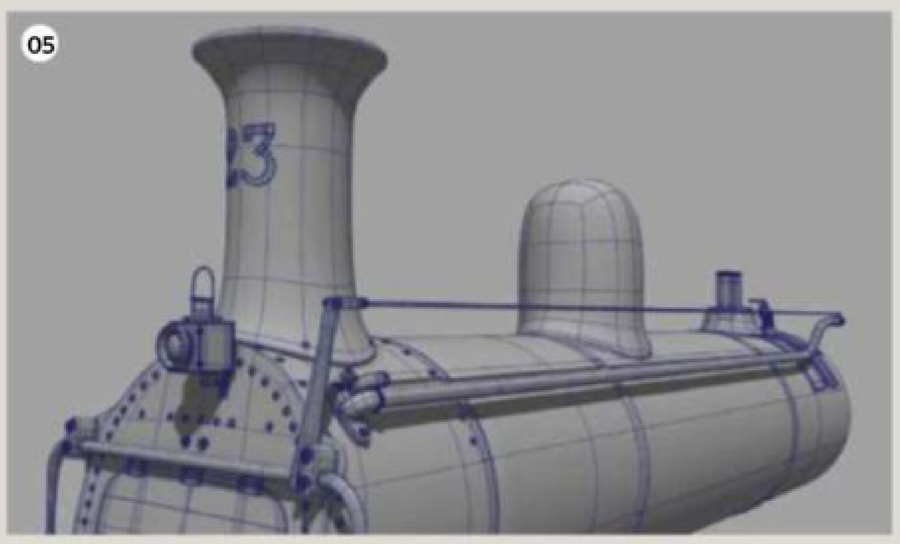
Next move on to create the boiler, the chimney, the steam dome and the steam-powered whistles. Refined cylinders will do the job for the boiler itself, with the front slightly angled to match the angle of the front plate that sits on the front of the boiler. Instead of having the chimney look as though it's penetrating the boiler by simply sitting it through the mesh, translate the vertices of the chimney to sit just above the geometry. Now create a tight edge around the chimney at the base to create an illusion of thickness. Also establish a tight edge at the top of the chimney so you can get a nice rim light affecting the mesh. To finish off the chimney, you can also add the 23 sign. For the steam dome and the steam-powered whistles that sit on top of the boiler, it's fine to just follow a similar procedure.

06 Shape the cistern

Once we have the boiler in place, we can add the water tanks (cisterns) that sit on either side. Starting with a cube, bevelling the edges should give you enough geometry to hold the form when the mesh is smoothed and also enable you to round out the two outside edges. Here you can add extra metal bars that sit on the inside and the many bolts that run along them. Instead of working them from new, try duplicating and repurposing some of the objects from the front of the train. There are also three plates that are bolted onto the side of the water tank, which can be included to, again, stay faithful to the source material. The bottom of the cistern will also need to be manipulated to make room for the wheels. You can repeat the same procedure for the tender at the back of the locomotive.

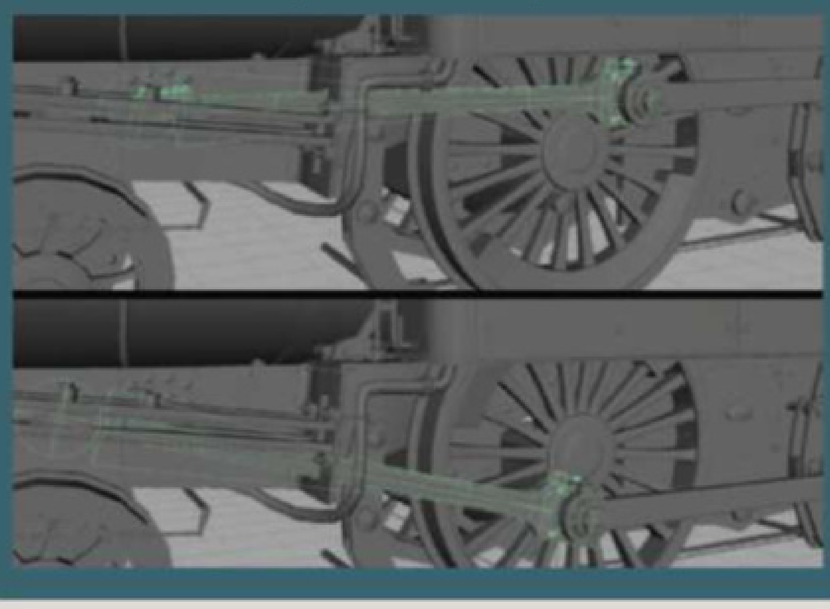


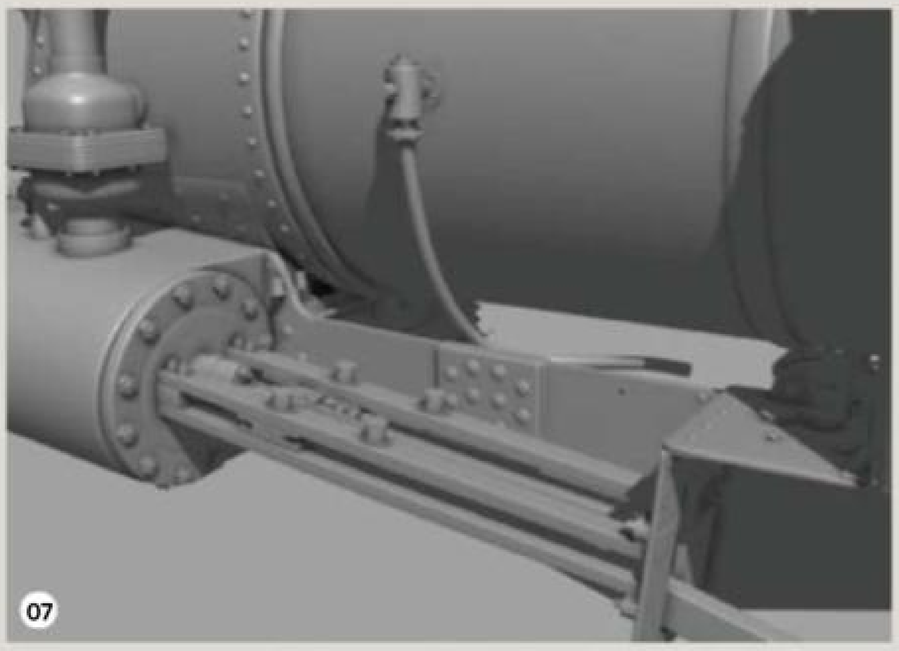




Testing out the mechanics

During the modelling stage, I think that it's very important to test out if the model will work mechanically. For the crankshaft, I created a very primitive setup to test this. Start with a two-joint chain that runs from the crankshaft to the where it meets the coupling rod. Next, parent the crankshaft geometry under the root joint. Create a locator and match its position to the end joint and parent it under the wheel geometry. Select the locator, Shift-select the coupling rod and go to Constrain> Point (Options), turn on Maintain Offset box and hit Apply. Select the locator, Shift-select the root joint and go to Constrain>Aim (Options). Enable Maintain Offset and hit apply. Now, if you rotate the wheel, the coupling rod and the end of the crankshaft will follow and you can animate the translation of the root joint to mimic the piston.

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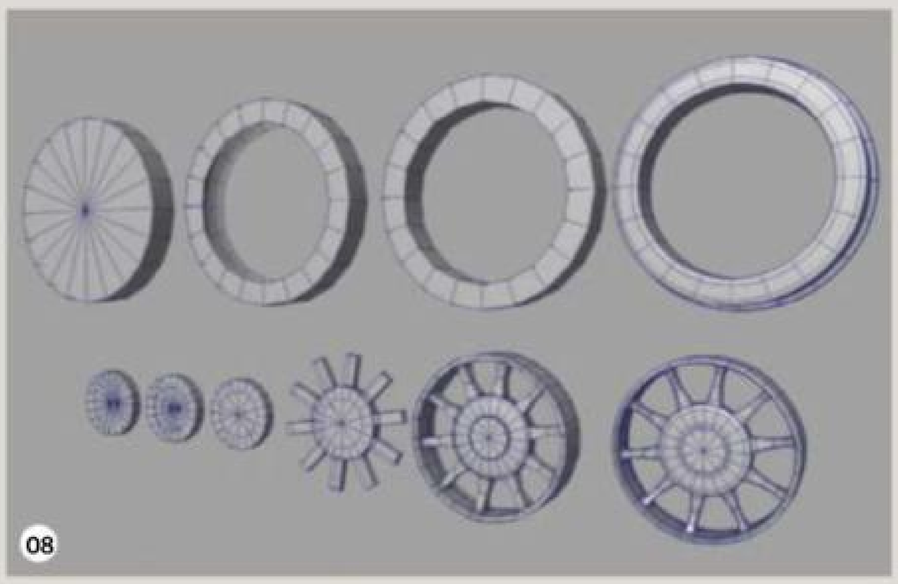
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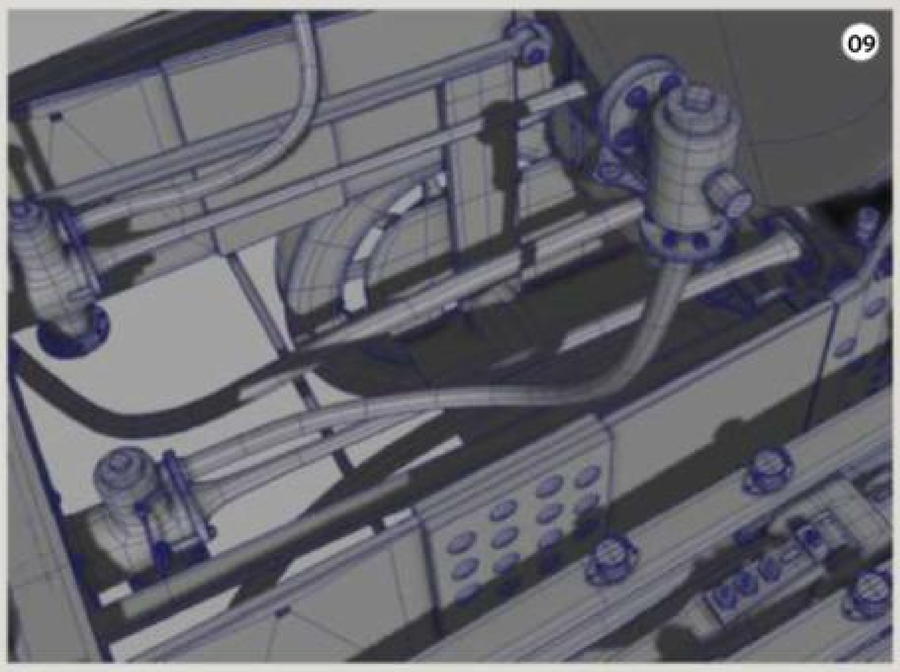
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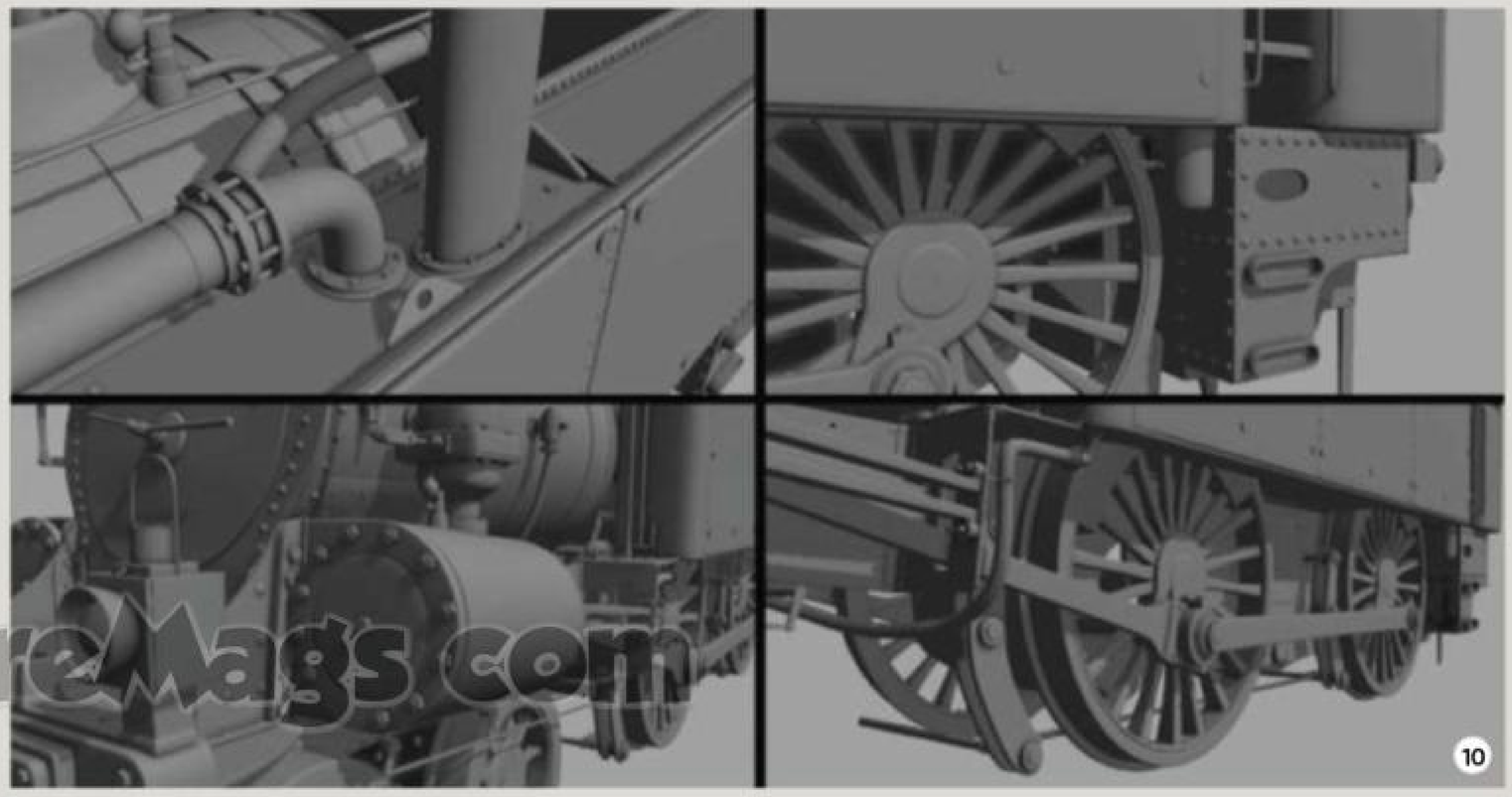
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KeyShot rendering

For the final render, I decided to use KeyShot. I grouped together the locomotive parts based on the type of object they were. For example, all the black steel parts were grouped together, the silver metal parts were grouped, the red elements and so on. Then I assigned each group a Blinn shader and gave it a base colour to match the type of object it was. I smoothed the model via Mesh> Smooth, exported it out of Maya as an FBX file and imported into KeyShot. With the Blinn shaders applied coming along for the ride, I could replace them by dragging and dropping from KeyShot's vast library of shaders directly onto the model. Play around with the lighting setups and you should be rendering out some cool images.

07 Pistons and crankshafts

Metal plates are connected to the cisterns that lead to the pistons at the front on either side of the boiler. Consider this area closely, as we will need it to work mechanically when we come to creating the rig. The pistons are at a slight angle, with the crankshaft stretching from the piston all the way to the first of the larger wheels through an opening on the metal plate that's connected to the cistern. You can then start to add the steel pipes that run from the back of the cistern into the top of the piston and then build the metal work that runs along the front of the locomotive, connecting the two pistons. Finally, add a coupling rod to connect the two large wheels together.

08 Make the wheels

The leading truck and driving wheels can be produced with much the same method and are composed of two parts of geometry – one for the inner and one for the outer portion. The outer portion begins as a cylinder rotated into position and scaled to match the reference. Select all the faces at the top and bottom of the cylinder, use the Extrude tool, scale inwards to match the thickness of the outer portion of the wheel, then grab the faces in the centre and delete them. Select the inner edge loop on one side and extrude towards its opposite side. Use the Merge Vertex tool to seal the geometry and you now have a hollowed-out cylinder where you can sit the inner wheel. Duplicate this now and scale it to be part of the inner portion of the wheel. Back to the outside portion, on the inner side, add some edge loops, select a ring of faces and extrude out so the wheel can sit on a track. For the inner portion, create a cylinder and scale it to match the centre shape. Next, run two edge loops around the cylinder, close to the rim. Select all the faces that lie in-between and around the object, then go to Edit Mesh and disable Keep Faces Together. Use the Extrude tool and pull out the faces along the Z-axis. Combine the portion that we duplicated earlier with the inner portion and then weld the two parts together using the Merge Vertex tool. Continue to add edge loops to make the wheels look less rubbery.

09 Build the undercarriage

Although the majority of the underside would be covered with nuts and bolts, it's still wise to add as much detail as you can. For this region, however, you can simply reuse many elements that have already been created for the rest of the model. This includes taking the geometry from the front of the train and combining it with some of the metal work of the piston and the coupling rod.

10 Final details

Once all the major shapes are in place, I found it necessary to add plenty of nuts and bolts to really finish it off. But – and I think this is an important point – I have not just randomly placed them here, there and everywhere. Again, I was trying to think about the make-up of the locomotive and how these parts are held together. For example, the metal plates on the cistern will need to be bolted on, the inner portion of the wheels is bolted to the outer portion and so on. Every piece of the train will need to be considered, so do this as a final sign-off to heighten the level of believability. Happy modelling and see you next issue!

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The advisors

ChronoSculpt
Cody Burke
www.chronosculpt.com

Cody Burke is a multimedia generalist currently working as the video editorial lead for the LightWave 3D Group – a division of NewTek, Inc – where he presents tutorials

3dsMax, FumeFX
Anselm von Seherr-Thoss
www.volatilevfx.com / www.incendii.com

Anselm is an award-winning VFX technical director and VES (Visual Effects Society) member. He's worked on movies such as *Avatar*, *G.I. Joe-Rise of Cobra* and *The A-Team*

With the Disc

Cody has supplied a host of project files, a video tutorial and screenshots of his settings

ESTIMATED TIME TO COMPLETE THE TUTORIAL
2 HOURS

LightWave, ChronoSculpt, Maya

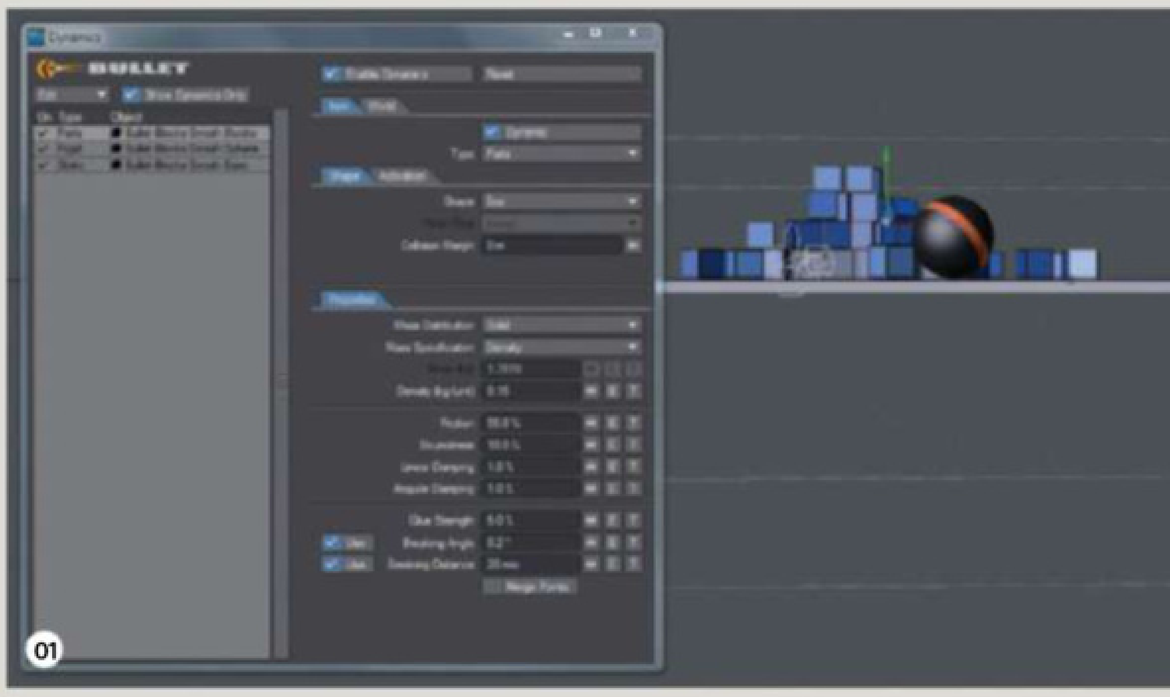
Use ChronoSculpt's Interchange option

"How can I use ChronoSculpt's Interchange capabilities to correct a dynamic simulation from one package and finish in another?"

ChronoSculpt is a powerful new standalone application that revolutionises the process of working with animation and dynamic simulation cache files. It does this by enabling you to use sculpting and transformation tools over time.

ChronoSculpt could potentially save you hours of work by enabling you to quickly make changes to the baked dynamic simulation cache files to address simulation jitter, soft-body penetrations, or to remove stray simulation pieces and get the shot out the door. A lot of the time, when in production, as the artist you are faced with the task of making sure assets/animations can smoothly transition from one package into another. With ChronoSculpt's robust Interchange options, it's very easy to import and export cache files for use in various 3D software.

To start, we'll purposely create a problematic simulation in LightWave using BulletFX. We'll then discuss the workflow for getting that motion data of the objects into ChronoSculpt, where we can easily fix the mistake that perhaps the production supervisor didn't like (without messing up the rest of the simulation). Once this is corrected, we'll then discuss the workflow for bringing in all the assets with their motion data into Maya.



01

growing community at www.3dartistonline.com

3ds Max, UDK

Rainer Duda
www.rainer-d.de

Rainer Duda is a freelance 3D generalist who has a specific focus on creating 3D assets for high-quality videogames. Here he takes you through rigging a vehicle asset

openPipeline

George Smaragdis
www.smaranimation.com

George Smaragdis is a visual effects artist, with particular skill in character animation, lighting, modelling and composition. He is currently working and residing in New York

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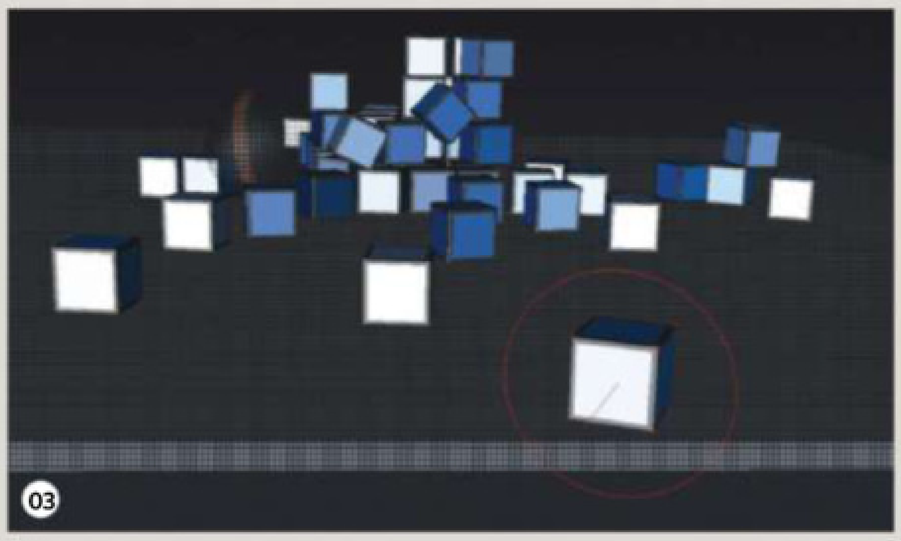
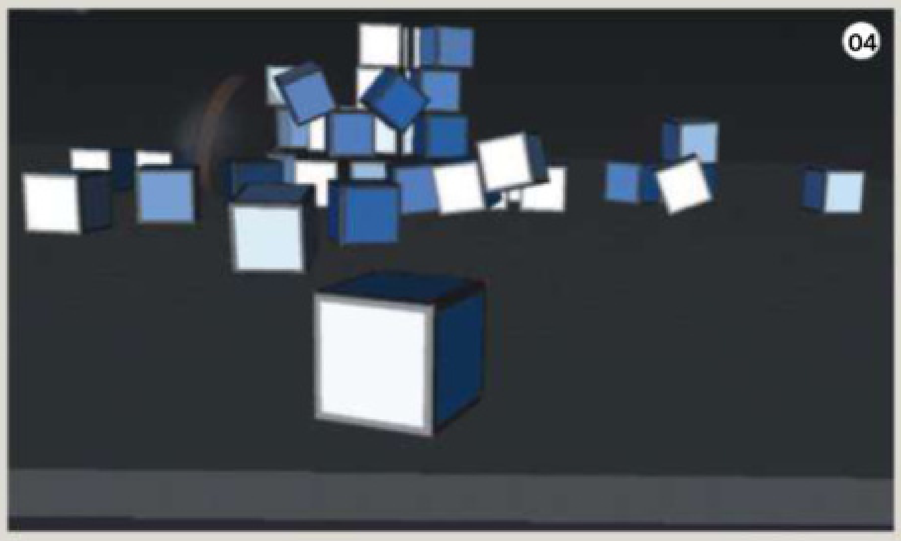
01 Make a problem

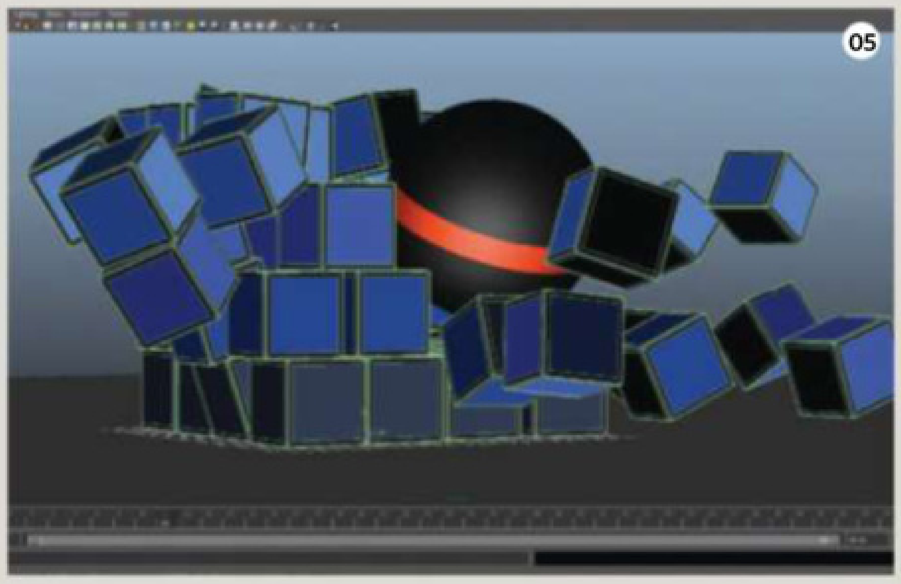
To begin, launch LightWave's Layout and load in the 'Bullet-Blocks-Smash.lwo' object from the tutorial files supplied with this issue. Position these blocks on top of the ground plane, the sphere above the blocks and apply dynamics to these three objects using the Bullet system. Select the sphere and, under the FX Tools tab, select Rigid Body. For the blocks, select Parts Body and for the base pick Static Body. Now open the World Properties panel and adjust a few of the settings for each object so just one block falls off the edge of the base. This falling block is the problem that we will now solve in ChronoSculpt without even touching the rest of the simulation.

02 Export the cache files from LightWave

To get the motion data of our objects into ChronoSculpt, we're going to use a LightWave native format known as MDD. First set the Timeline slider to frame 0, then simply select the object you want to get the MDD file from, go into the Object Properties by hitting the P key and, under the Deform tab, add the displacement known as MD Baker. Specify where you want to save the file, make sure the format is set to MDD and hit OK to confirm. You can repeat this exact step for the blocks. Since the base is only there for collision purposes and has no motion, we don't need to export a motion file for it. While we're in Layout, we can also export a packaged FBX file to later bring into Maya. To do this, go to File>Export>Export FBX. The default settings are fine, just make sure to only leave Models, Materials and Embedded Textures enabled. Everything else with a check box can be disabled. Hit OK and this FBX file will now contain all three of our objects for use in Maya.







03 Correct the simulation in ChronoSculpt

In ChronoSculpt, load in the 'Bullet-Blocks-Smash.lwo' file from the Content Directory. You can use Cmd/Ctrl+Tab to cycle through the different layers (objects). With the sphere highlighted, and the folder containing the MDD files opened, drag and drop the sphere MDD file into the interface. Switch to the blocks layer and repeat that step. You should now see your animation exactly as you did in LightWave. Scrub through the timeline just before the point where the one block falls off the edge of the base. Under the Tools menu on the left of the interface, select Pin. Scale up the Brush Size a bit using a Ctrl/right-click and apply or brush over that block. You'll now notice that a pinning morph has been placed on the timeline in red and if you scrub through, the object stops right before it falls off the edge.

04 Export cache files for use in Maya

Since MDD files are native to LightWave, we need to use a motion data file that's compatible with Maya. In ChronoSculpt we have the option to export Maya cache files, so that's exactly what we are going to use. Reduce the timeline to be as many frames as the MDD cache file, which in this case is 45, then cycle through the different layers, and, again, we will just be exporting the sphere and block objects, since the base has no motion. With the sphere selected, go to File>Save Maya Cache and repeat the same process for the blocks.

05 Finish in Maya

Once in Maya, go to File>Import Options (by clicking on the box next to Import) and set the File Type to FBX. Next, import the FBX we recently created in LightWave's Layout. You'll notice that each individual object can now be selected, so, once you've grabbed the sphere, switch to the Animation menu set and, at the top of the interface, go to Geometry Cache>Import Cache. Now select the sphere Maya cache file we exported from ChronoSculpt, repeat this step for the blocks and you'll notice that the animation is there, but the sphere and blocks are raised and may be positioned incorrectly. This is because, in ChronoSculpt, the Maya cache was baked in a world space, resulting in the transformation being applied twice in Maya. To fix this, simply select the sphere and blocks and set the X, Y, and Z values to 0.

Important points about Interchange

When switching between different applications with the same models, it's important to understand that not all applications support the same type of geometry, or even the same naming conventions. For this reason it's always best to model your objects all in quads, although a few triangles should be okay if they're needed. Also, when exporting the Maya cache files out of ChronoSculpt, make sure that the names are simple, with no hyphens. In our case: sphere and blocks.

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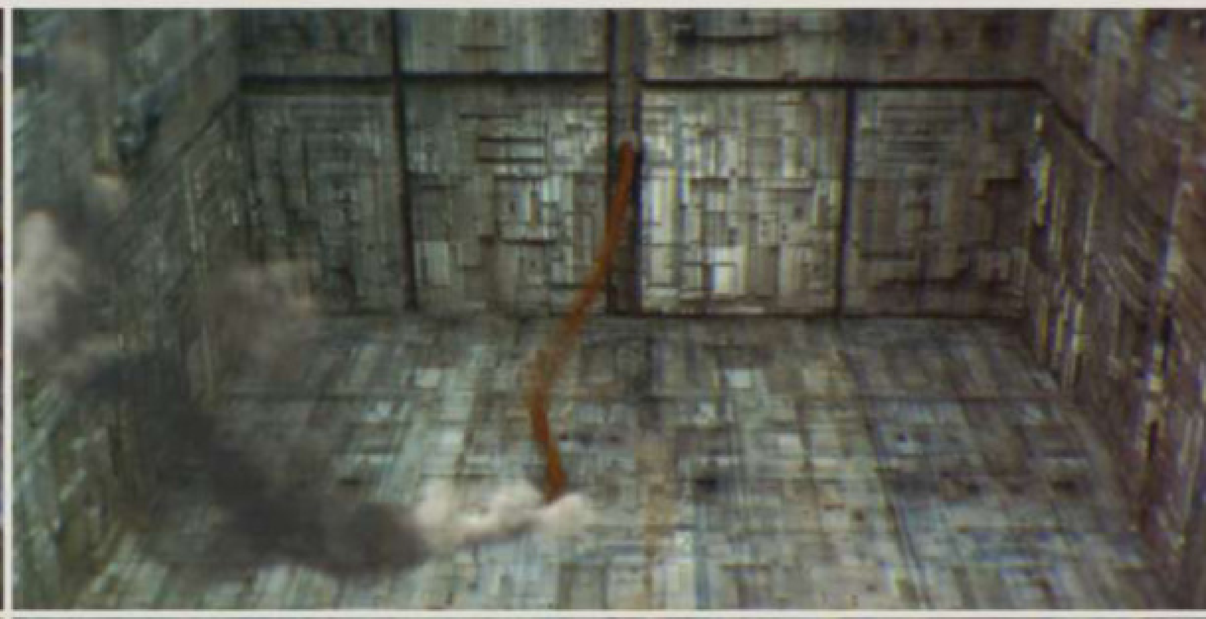
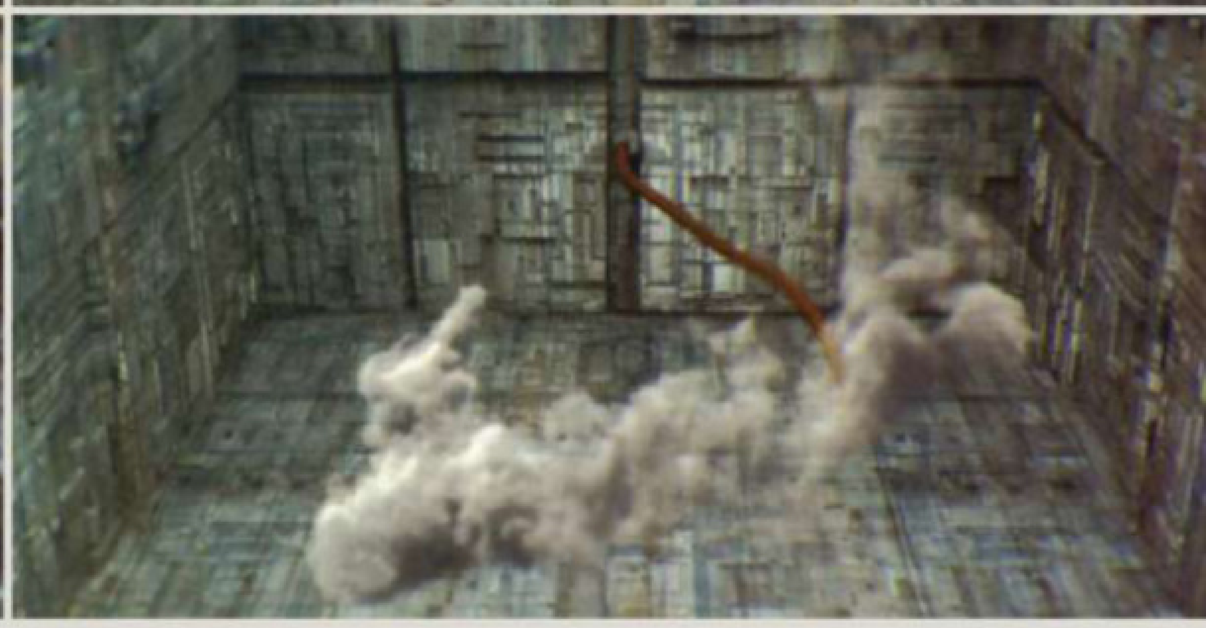




ESTIMATED TIME TO COMPLETE THE TUTORIAL

30 MINS

With the Disc

Tutorial files:
Anselm has supplied each individual step as a saved MAX file (3ds Max 2014) and tutorial screenshots of his settings

3ds Max & FumeFX

Create a busted hose with 3ds Max

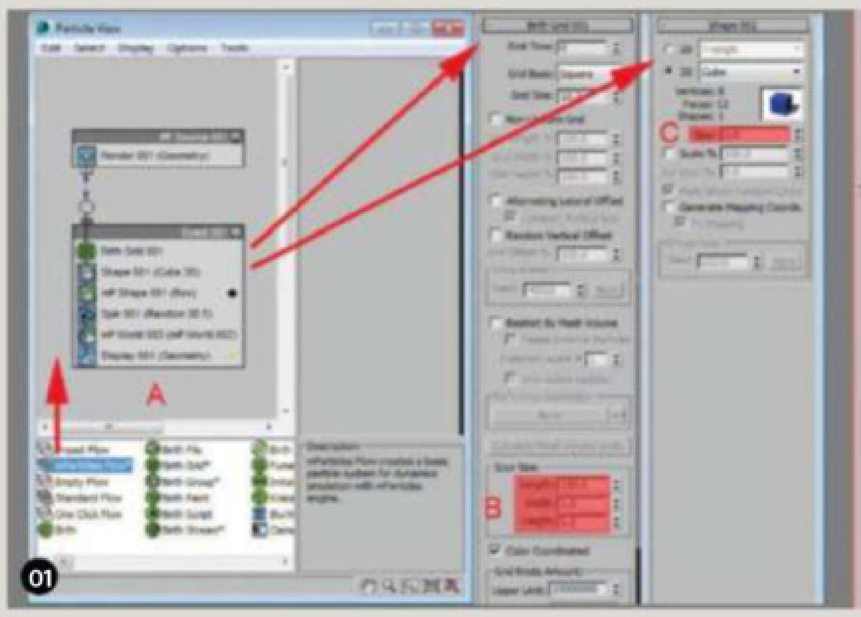
"How can I procedurally animate a loose, busted hose with particles, as well as simulate smoke?"

With the Particle Flow toolbox extensions (Box#2/3) now being on board in 3ds Max 2014, the possibilities for complex out-of-the-box effects are huge.

The formally known Toolbox 2 is now called mParticles, which is now more intimately integrated into the 3ds Max workflow. While mParticles concentrates on the integration of the PhysX rigid-body engine, the new ADM (Advanced Data Manipulation) extension focuses on creating your own PFlow operators. We are going to use mParticles this time to create our loose, busted hose that whips around. I used this technique in production on *Star Trek: Into Darkness*. The hose will react to obstacles in the scene and make use of the mP Force and mP Glue operators to link particles together and connect them to a chain. With mP Forces we can use Legacy Force gizmos, such as Wind, to animate our hose in a convincing way. No hand animation skills are required and the same techniques can be used for procedural animations such as worms or sea anemones.

Once happy with the motion, we can use the new Particle Skinner, which works much like the Skin Wrap you might be familiar with for regular geometry, but this one works with particle systems. This means we'll be able to skin one or many high-res hoses to the particles. In the last step we are going to emit particles off of the tip of the hose and use them as FumeFX emitters for violent steam spurting out of the hose.

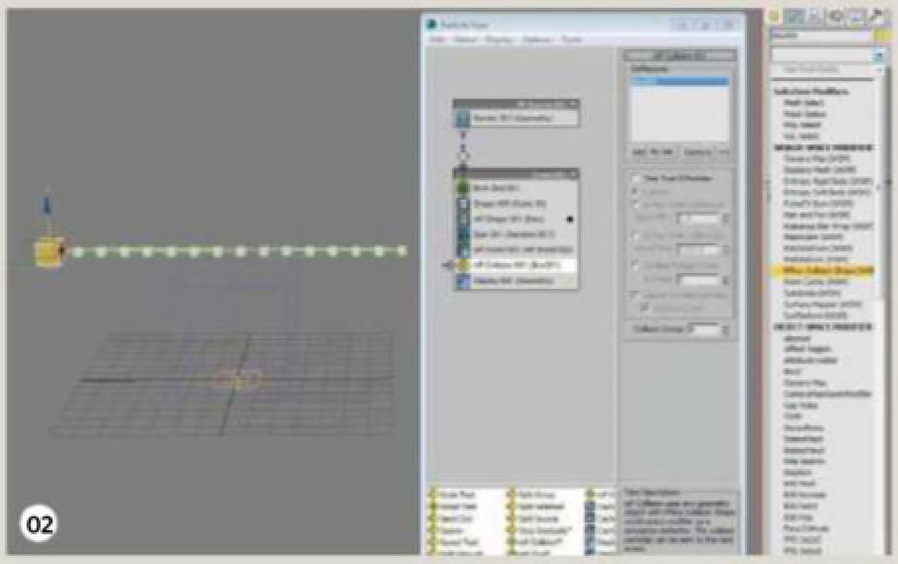
An essential MaxScript when working with particles is the PFlow Baker, which we'll need that to bake particle animations: www.scriptspot.com/3ds-max/scripts/pflow-baker.



01

01 Create a default mParticles flow

The first step is the easiest. With 3ds Max 2014 open, hit the 6 key on your keyboard to open the Particle View. On the bottom you can see the depot of standard flows and operators. Pick the mParticles Flow and drag it into the Particle View. If you scrub your timeline, you will see the particles falling and colliding with the floor and other particles with accurate shape collisions. Adjust the Birth Grid 001 to Length: 150, Width: 1 and Height: 1. This will create a line of particles. The Size of the Shape 001 option should be adjusted to 3.



Navigate the mP World – more steps equals greater accuracy

When working with mParticles, the overall stiffness and accuracy can be controlled in two ways: Global Particle Subframe Sampling and in the mP World Helper. If a simulation tends to explode or be too sporadic overall, it might just need more samples! Higher Subframe Sampling causes the PhysX engine to keep things in check better. To globally slow things down, the mP World Helper has a Time Scale Spinner. This is a great way to slow things down when you're already happy with the overall motion. To prevent a PhysX explosion, adjust the Sleep Thresholds and Frictions as well as Convex Hull Generation settings in the mP Shape operator.

02 Build and add some collision objects

Create a box on one end of the Birth Grid, then add a PFlow Collision Shape world-space modifier on top of the box and check Activate. Now that this box is part of the particle world we can add an mP Collision operator under the mP World. All tests in mParticles have to be under the mP World in order to work. Add your box into the list of collision objects and when you play the simulation back you will notice that the particles still just fall down, so we need to connect them.

03 Glue the connections

We are going to use mP Glue, which has three different binding types, but here we'll use Rigid, as it connects the particle at the pivot points. The Binding Distance should be higher then the Birth Grid Distance. If the Grid Distance is 10, your Binding Distance should be 15, for instance. Make sure you have Visualize Binding checked in order to see connections. Last, scroll down in the mP Glue test, then check Deflectors and add in the Box in the To Bind With section. This way the particles will bind with one another and the deflectors will be added to the list.

04 Apply forces

Now drop an mP Force operator into the flow but above the mP World. Create a Wind force and have it point slightly upwards in the direction you want it to blow. Adjust the Wind settings to Strength: 0.1, Turbulence: 0.25, Frequency: 0.25 and Scale: 0.05. In the mP Force operator, adjust the Influence and Exponent until you like the motion. If you want an overall tighter simulation you can also go into the mP Word and, under the Advanced Parameters, raise the Subframe Factor. A value of 4 worked pretty well here, but extra steps will provide a more accurate result.

05 Make the hose

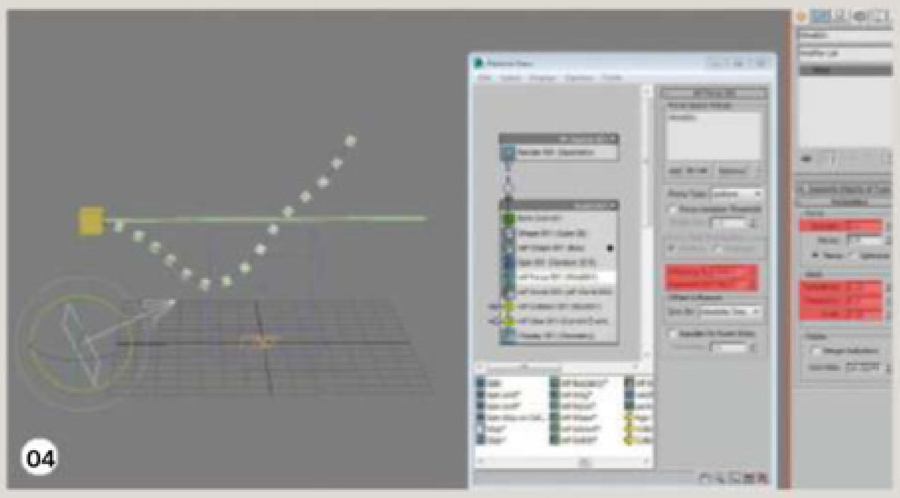
Create a Cylinder and match the Height and Radius to the particles. Make sure to have enough segments in your Cylinder to enable bending and delete the caps on the ends so it's a tube shape. Noise can be added to the ripped end to suggest that this pipe was once attached to something. Now you can add a Particle Skinner modifier, pick your particle system and hit Activate Skinning. The Distance Influence should be similar to your Binding Distance. Add a Shell modifier on top to provide thickness. At this point you should cache the particles inside the mP World helper. Hit Cache/Bake Simulation and afterwards check Run Baked Simulation.

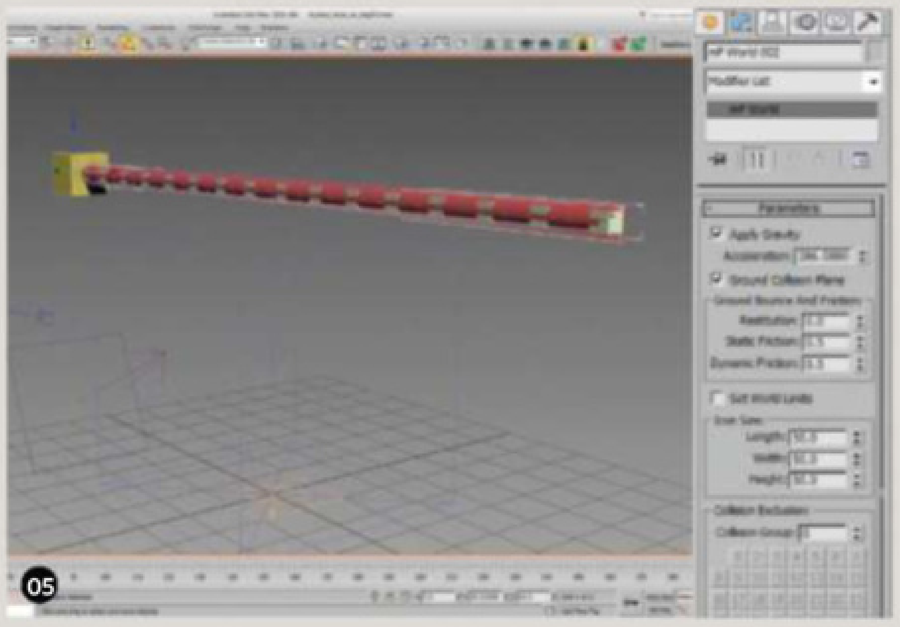
06 Use a particle emitter

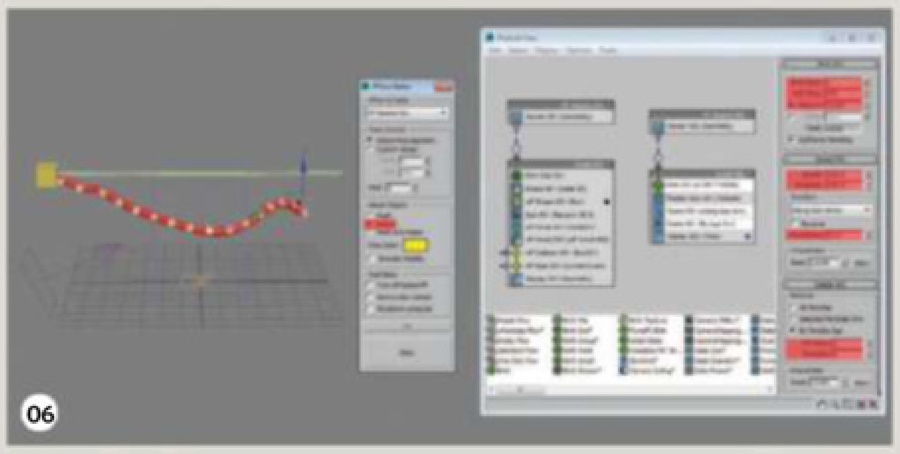
PFlow Baker can be very helpful for plotting out positions of particles as meshes or helpers: www.scriptspot.com/3ds-max/scripts/pflow-baker. Pick the particle system and bake out helpers. Delete all but the tip helper and you'll have something to link a second particle system to. Create a new Standard Flow from the depot, make the emitter icon a circle and adjust the Diameter to be smaller than that of the hose. At frame 0 align and attach the new Particle Flow to the baked helper. Adjust the Birth Amount and Duration as well as Speed and Divergence. Add a Delete operator with a Duration of 2 and Variation of 1 to kill the particles shortly after bursting out.

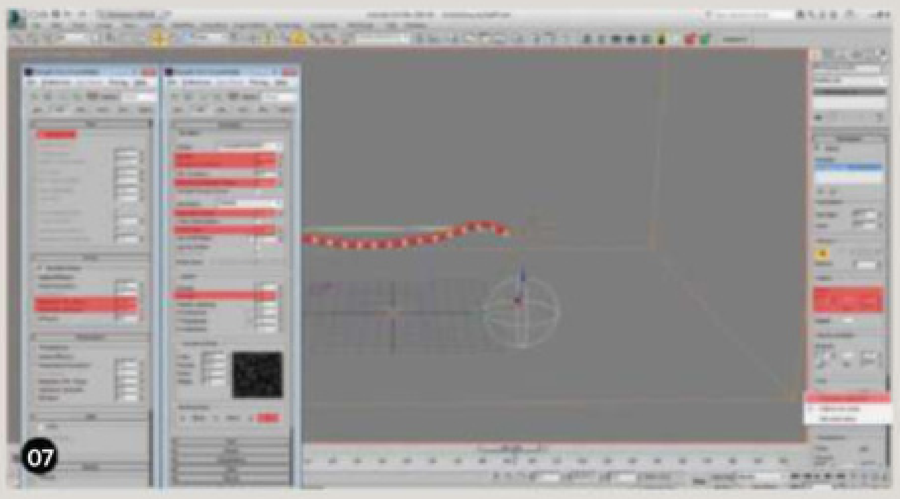
07 Move to FumeFX

Create a FumeFX grid that encloses the scene so the hose is always inside the grid. Add a particle source and pick the PF Source 002 as the emitter. Adjust the Radius in the Particle Source and disable Fuel Emission, as we only need smoke. Also uncheck Simulate Fuel in the FumeFX Sim tab. While you're in the Sim tab, adjust your Maximum Simulation Steps and Time Scale if your hose wiggles very fast. If you want the floor to be a collision object for the smoke, check -Z in the Blocking Sides. To get finer detail in your simulation, lower the Advection Stride and bring up the Vorticity. For faster simulations, lower the Quality to 3 and the Maximum Iterations to 50. You'll also want to have a high Dissipation setting so the steam appears to be cooling fast.









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ESTIMATED TIME TO COMPLETE THE TUTORIAL
1 HOUR

With the Disc

Tutorial files:
Rainer has included a tutorial video and the charger mesh – including one UV set, smoothing groups, rig and skin – ready to import into UDK, which can be downloaded for free from **www.unrealengine.com/udk/downloads**

3ds Max, UDK

Rig a videogame vehicle

"How can you rig a vehicle for use in a game engine, such as the Unreal Development Kit?"

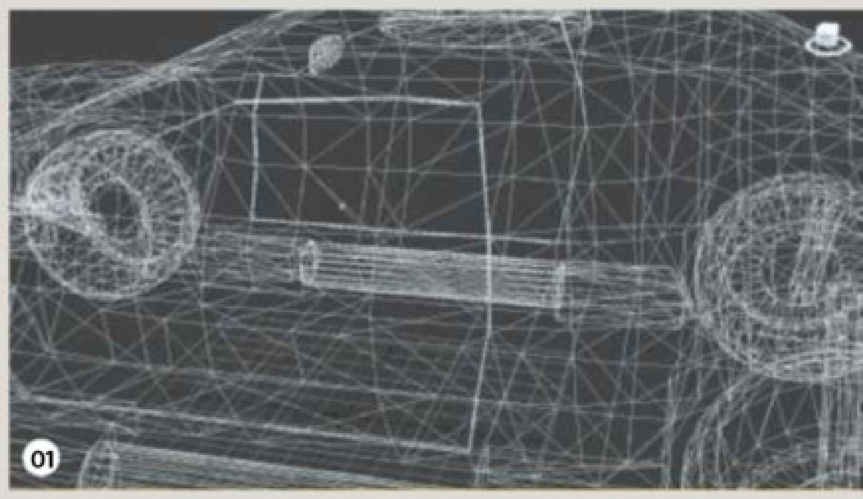
In issue 60 we explored how to make a game-ready vehicle and now we'll look at how to rig it. It's not that hard to prepare a dynamic actor such as a vehicle for UDK and here we'll cover the fastest and easiest way to drive custom-made vehicles.

Here 3ds Max will be used for a proper rigging and skinning process. However, the package used is a minor matter, as UDK supports the universal FBX file format.

There are some special bones that need to be set corresponding to the object class, which will be used for coding, including bones for tyres, suspension and the chassis. Here we'll make use of the SVehicle.uc class, because it's a bit easier to start with than jumping directly into the UTVehicle.uc class.

After the export from the 3D application we can create a special package inside the UDK. The charger vehicle mesh (supplied with the issue) is rigged and skinned, but for the script we need to set up more than the basic material for the look. In addition there must be a physics asset in place, an Animation tree and a physical material applied to the basic material. The physics asset, for example, will take care of the vehicle collision. We will make use of two different kinds of collision methods. Furthermore, the physics asset, in combination with a physical material, is responsible for the vehicle mass and inertia. Although the vehicle has no animations to play, it's recommended to add and set up an Animation tree, as the UE vehicle system works with a special controller for skeleton controls to move bones in the game procedurally. Another controller used is the suspension kit.

Not every feature needs a special bone from the 3D application. If there are some extra features required, such as muzzle flash or even a player camera, then sockets are also handy. The next step is the exploration of the Socket system and how to prepare feature-specific anchors.



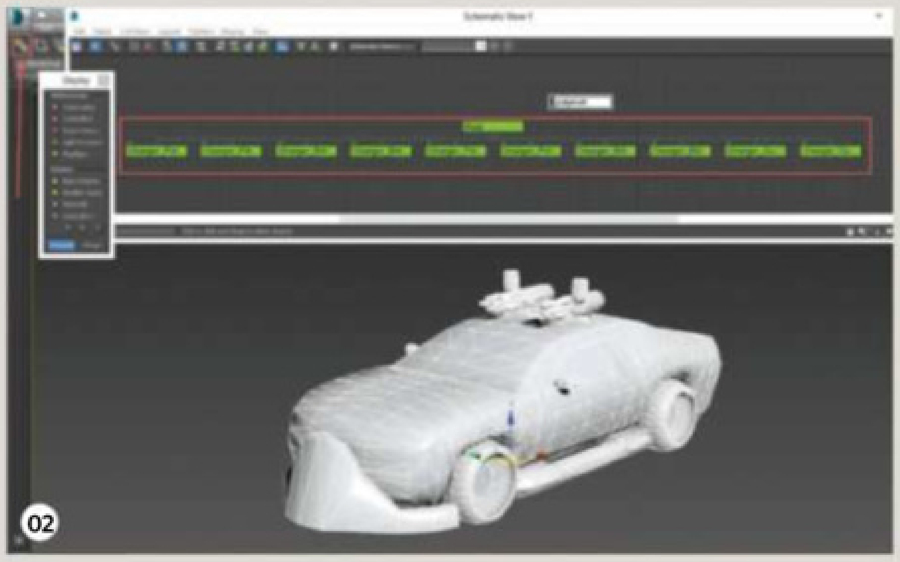
01

01 Place the helper objects

To begin, import the charger model from the supplied files, then just duplicate the skinned mesh and delete the helpers for a fresh start. The helper objects are located in the Modifier tab, under Create, in the Helpers sub-menu. In total we will create 11 helper points. There will be one for each wheel and one as a suspension bone. The chassis and suspension helper position will be the centre of the corresponding elements. Each weapon helper needs to be at the weapon base. Weapons need at least one single helper and each wheel helper position is the centre of the back side.

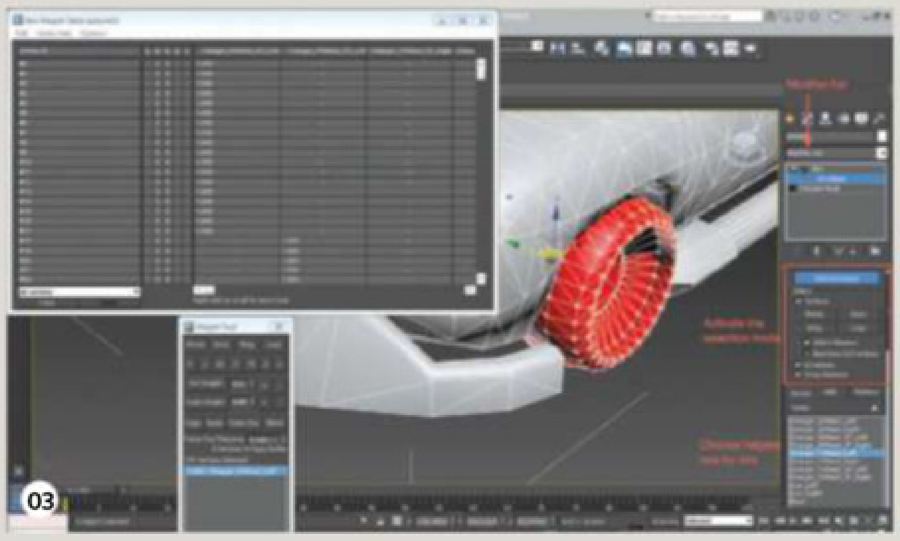
02 Correct parenting

The chassis helper will be the root and all other helpers must be the direct children of it, but first we need a naming convention such as 'Charger_Gun_Left' for the weapons and Root for the chassis. The wheels can use a name similar to 'Charger_FWheel_Left' and for the suspension, 'Charger_FWheel_SP_Left'. Now select all the helpers without the chassis helper. For the next step, activate the Select and Link function just below the main menu. Now we can create a connection by clicking one selected helper and dragging the symbol to the chassis helper. Now open a new Schematic view via the Graph Editors menu.



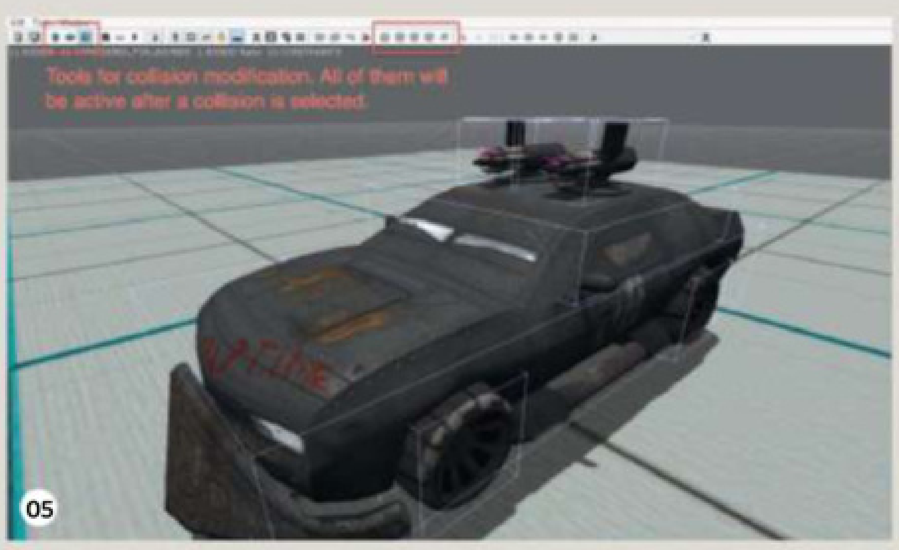
03 Start skinning

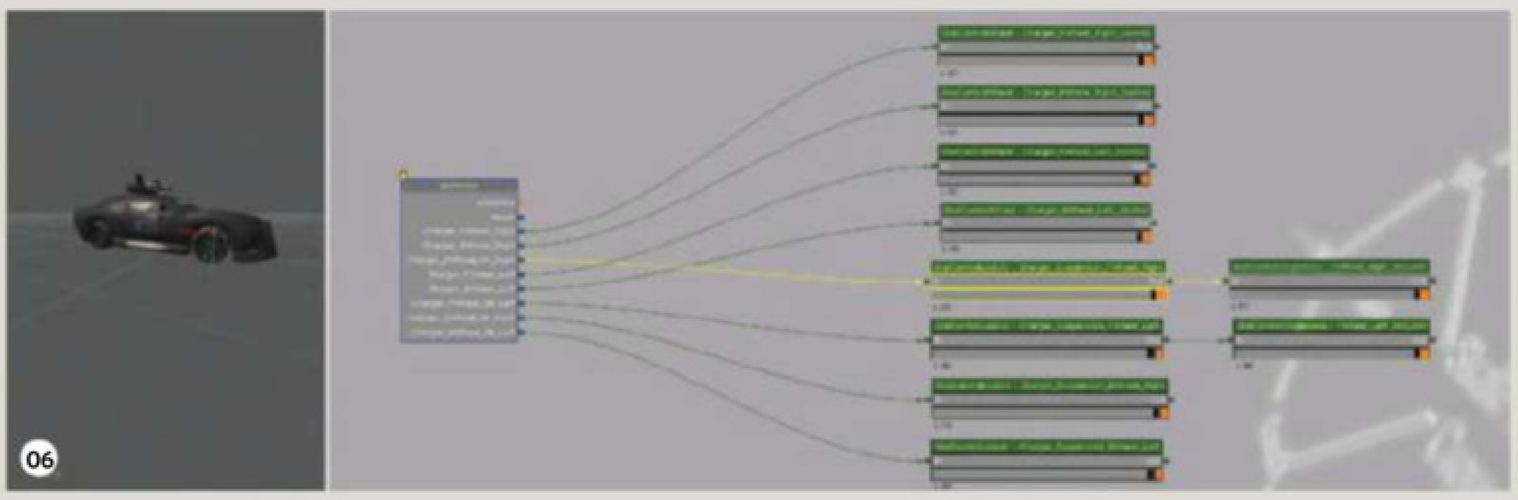
Next, apply the Skin modifier to the charger mesh. Modifiers are located under the Modifier drop-down menu in the right-hand Menu bar at the top. There are two options for setting everything up. The first is by using the Skin Weight Table. For instance, if the front-left wheel has all the points selected, all the vertices need to have a 1 in the Weight Table value at the specific helper Charger_FWheel_Left. The same must be applied to every bit of geometry and the helpers that belong to them. The other option is the Weight tool, which is accessed by clicking the screw wrench icon.



04 Establish a solid base

Export the charger with the FBX exporter, including activated smoothing groups and a checked Animation box for the skinning properties. Subsequently, in UDK, it's recommended to create a new package with sub-folders and a proper naming convention, which makes things easier. Create a new package inside the Content Browser by pressing the New button and choose a location to save. You can directly create a material by choosing Material as Factory. The name will be something like M_ChargerBase. In the Grouping field just add the name 'Materials', which will be interpreted as a sub group. Import the skinned charger and equip it with a material, plus textures.





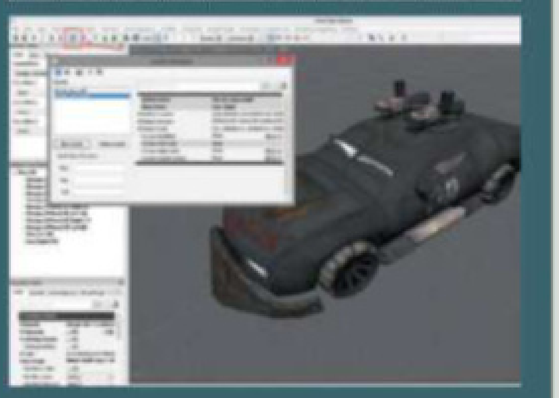
05 Basics for interaction

Next we need to create and apply a physical material, which is responsible for defining the behaviour of physical objects to the corresponding slot in the material. To make new assets, such as physical material, just Ctrl/right-click inside the charger package and choose it. Another important asset, especially to give the skeletal-mesh collision information, is a physical asset. To create a physical asset, Ctrl/right-click on the skeletal mesh and select Create a new Physics Asset. After this all the helpers will get a collision box that covers the whole skinned geometry parts individually. To modify the collisions, use the menu directly above the viewer.

06 Correct gear is the key

Add an Animset in the package via a Ctrl/right-click on an empty spot in the package. Inside this Animset there's an Animation tree set up. It's necessary to add skeletal control chains for each tyre bone together with the corresponding suspension bones. Each wheel bone will be connected to a Skeleton Control Wheel node with a controller name, correct wheel steering and roll axis settings. The suspension bones will be connected to a skeleton-connected LookAt node and a Skeletal Control Singlebone – both with a proper controller name and correct axis settings. Change the target location space to another bone space inside the skeleton-connected LookAt node. In addition, add the name of the related tyre bone inside the field target space bone.

Setting anchors



Once you've completed the six steps here, there are anchors left to place if you want to place the player camera and some particle effects such as muzzle flashes for the guns or exhaust smoke. These sockets can be created directly inside UDK by double-clicking the skeletal mesh. The number of sockets required depends on how much realism you're aiming for. As default for this tutorial only two will be created, for the muzzle-flashes. If a socket is created the first thing it wants to know is which bone will be the related bone. After this the socket can be moved to the correct position.

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ESTIMATED TIME TO COMPLETE THE TUTORIAL

1 HOUR

OpenPipeline

Create an efficient workflow

"What can I do to make my projects faster, more efficient and organised?"

With the Disc

Tutorial files:
- disk.mb
- Space.mb

You'll also find Geo and scene files used in the project (compatible with Maya 2013).

In the fast-paced world of commercials, films and music videos, deadlines are cold, harsh mistresses that wait for no one.

The correct use of a pipeline program can effectively diminish the chance of the project becoming derailed by misplaced assets, loss of backups and scattered files. Larger studios such as DreamWorks SKG and Pixar developed their own proprietary pipeline programs over the years and have meticulously addressed all the issues that pop up in the middle of a hectic production, juggling thousands of models, textures and animation files. However, these kinds of tools can be incredibly useful for the independent artist and are often key to keeping track of your masterpiece!

A pipeline is whatever you want it to be. It's simply a collection of convenient organisational tools that make you work faster and more efficiently. But some of the concepts are similar throughout the gamut. The foundation of the modern pipeline is hierarchical referencing – you start with a model and that is then saved in your Models folder. You then reference your model into your rig scene and save that scene under your Rigs folder. Then you reference your rig scene into your animation scene. All of this ultimately means that every time you update your model, your rig gets automatically updated, your animation is instantly updated and you just have to open your lighting scene and press Render, without worrying about repeating every single step.

On top of this basic function, you can create custom pipeline tools that automatically set up your render settings, take your rendered frames, set up a NUKE composition and render a QuickTime file, just with the push of a button! Or you could create a tool that automatically creates all the render layers you need so you don't have to spend time setting those up again and again.

But, most importantly, this process keeps files organised and collected so you and your team know where to find them. In this tutorial we'll be using the free program OpenPipeline (www.openpipeline.cc) that offers an elegant and simple solution used by independent artists and large studios alike. More specifically, we will be looking at the making of the Starcadian music video for *HE^RT*, which used OpenPipeline for its CG assets management. The full-length video is available online at https://vimeo.com/43356088).

01 Set up your pipeline

I like to keep all my projects in C:\PROJECTS. Using the Project Manager, define your Projects Location and add a New Project. In this case, we'll name the project 'HEARTVIDEO'. Enter C:/PROJECTS/HEARTVIDEO as the Projects Path and leave the rest as default. This will essentially create a default Maya project structure in that folder and keep all files you use from now on in there. Notice how in the main OpenPipeline window, under the Project Name dropdown, HEARTVIDEO is listed. Any projects you create will be listed there and you can switch between them.

02 Set up your assets

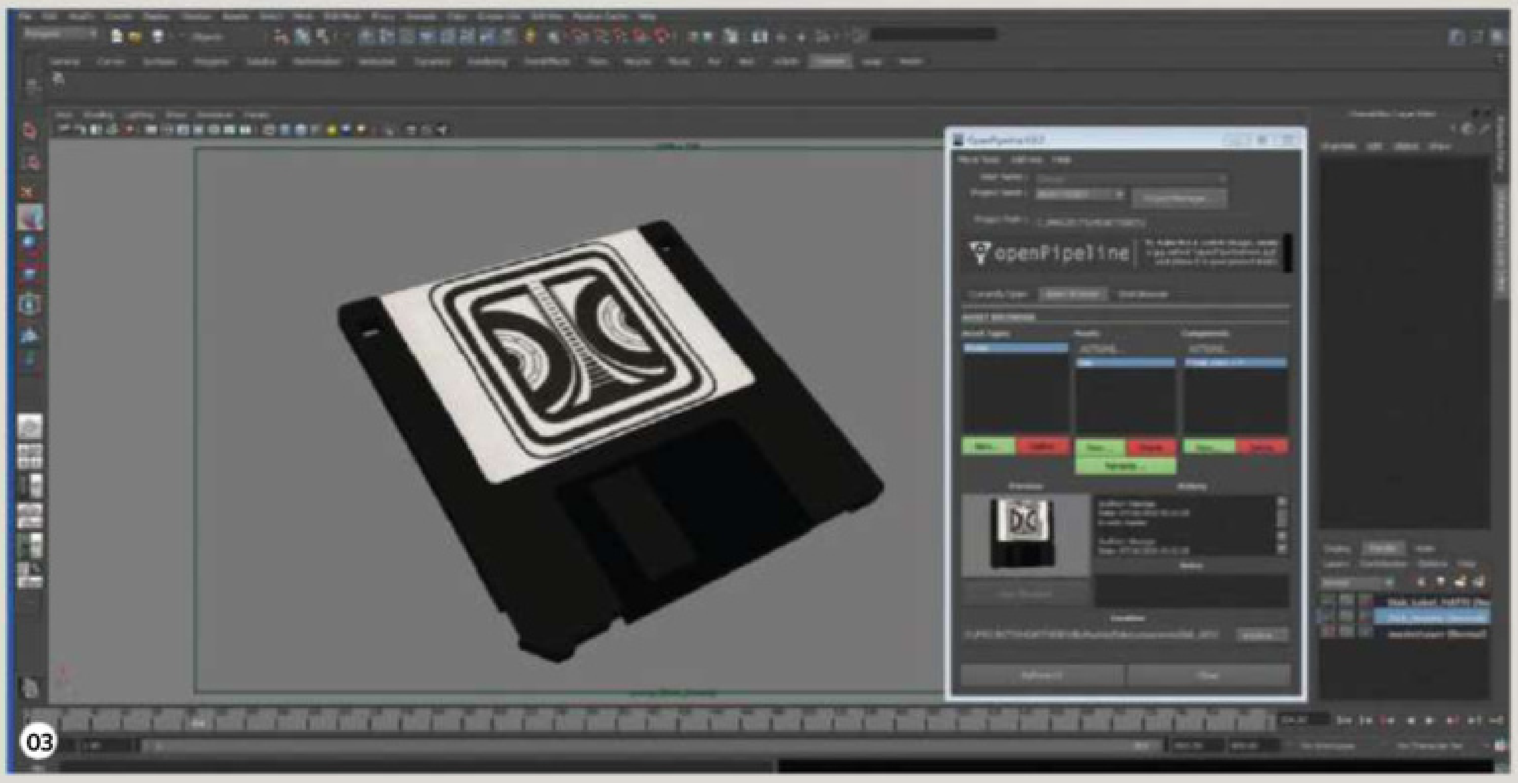
Now let's take a look at the Asset Browser. You'll see three columns: Asset Types, Assets and Components. Asset Types are the broad categories of elements (actors, lights, cameras and so on). Assets are the individual elements of those categories (main actor rig, lighting rig, camera rig) and Components are the parts of each asset. Under Asset Types, click New to make a category called 'Actors', select this and move to the next column. Click New again and create a new Asset called 'disk_RIG'. Select disk_RIG and, in the last column, create a Component called 'disk_GEO'.

03 Import models

Now it's time to import the models. By now you should have an empty scene open, but with empty categories and subcategories. Let's remedy that by opening disk.mb through Maya's File menu. Go to the OpenPipeline window, double-click the disk_GEO component and confirm Current Scene. You will be taken to the Currently Open tab, which displays information about your currently open scene. Click Save Master to confirm and finish.

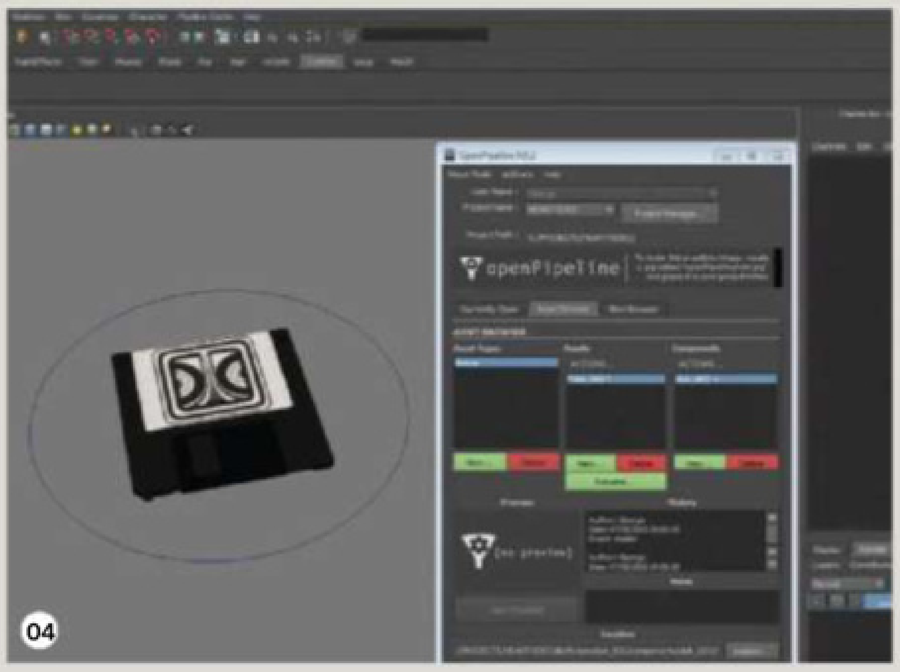
Tips and tricks

If you see asterisks around an asset type or a component's name, it means that it's currently open. If there is a plus sign next to it, this means that there is a master file that was saved at some point. If there is a minus sign, that means there is no master. You can also create snapshots of your objects for easy browsing, if you go to the Currently Open tab and click Take Snapshot.



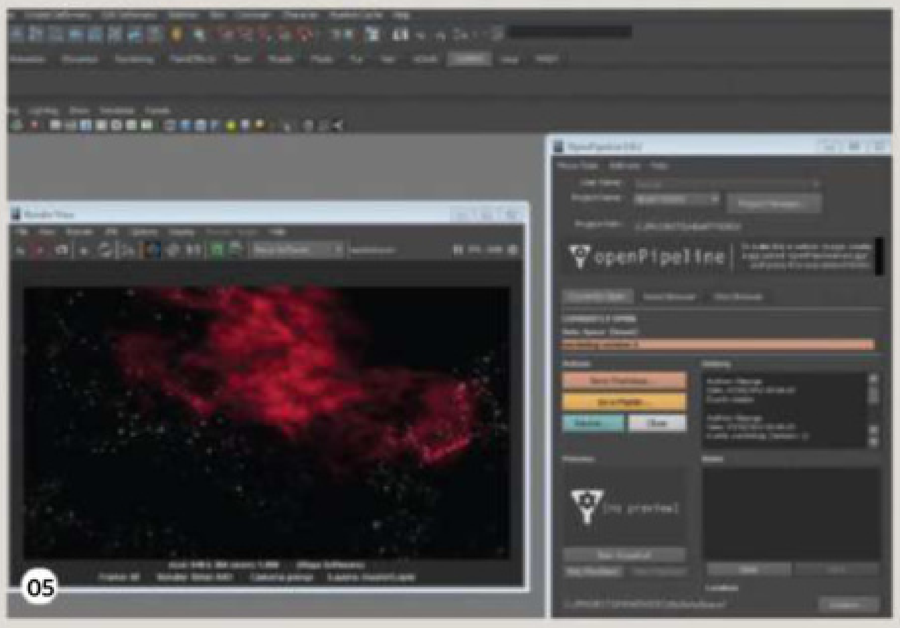
04 Rig your model

We have used disk_GEO as the place to put our geo, so let's use Disk for our rig. Double-click Disk and select New Scene. Now, in the Asset Browser, Ctrl/right-click disk_GEO and Reference the Master file. This way every time you master the Geo, it'll be updated into the rig file. Next, create a group called 'GEO' and a group called 'CRVs'. Place the referenced disk into the GEO group and place a newly created Nurbs curve into the CRVs group. Now parent constraint the GEO group to the curve. You now have a disk rig, so save your Disk master to insert it into the pipeline.



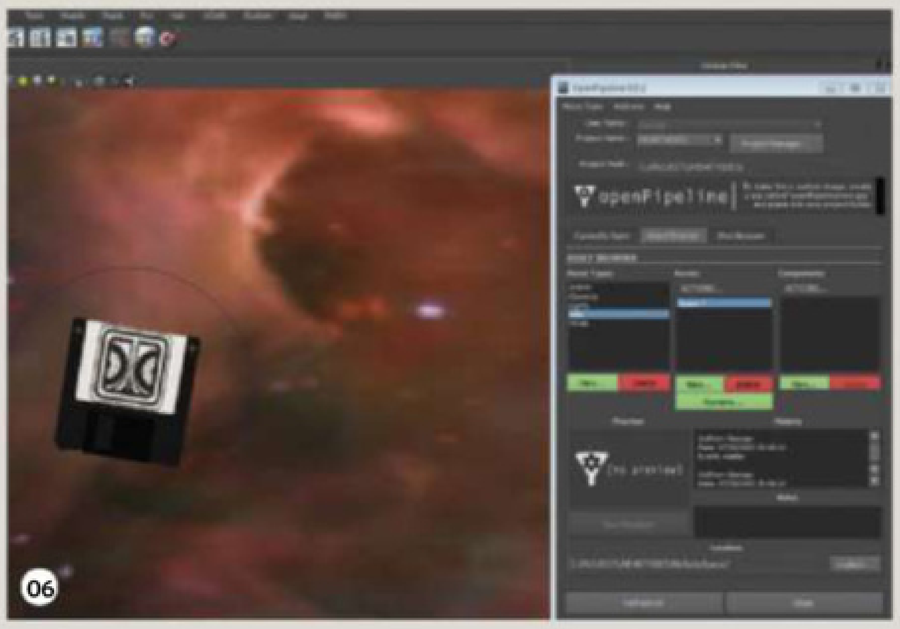
05 Add the final assets

Make a new Asset Type called 'Lights' and create an asset for it called Light_rig. Set up some lights in it however you wish and save a master. Now, with the same steps, create a Camera_rig and save it under a new asset type called 'Cameras', in an asset called 'camera_RIG'. Finally, create an Asset Type called 'Sets' and, inside it, create an asset called 'Space'. Import the Space scene supplied and save the master. Now you have adequate assets in the pipeline to finally assemble your scene!



06 Piece the puzzle together

We can now compile the final scene. Under the Shot Browser tab, make a new Sequence called 'Space', then add a Shot called 'Shot 00'. Double-click it, go to disk_RIG, Ctrl/right-click it and select Reference|Master. Do the same for camera_RIG, light_RIG and Space. You now have all your assets referenced in and ready to be animated! As an added convenience, save this scene as a Master, so that you can use it as a template for future shots, instead of having to reference everything from the ground-up. You have now completed your first OpenPipeline!



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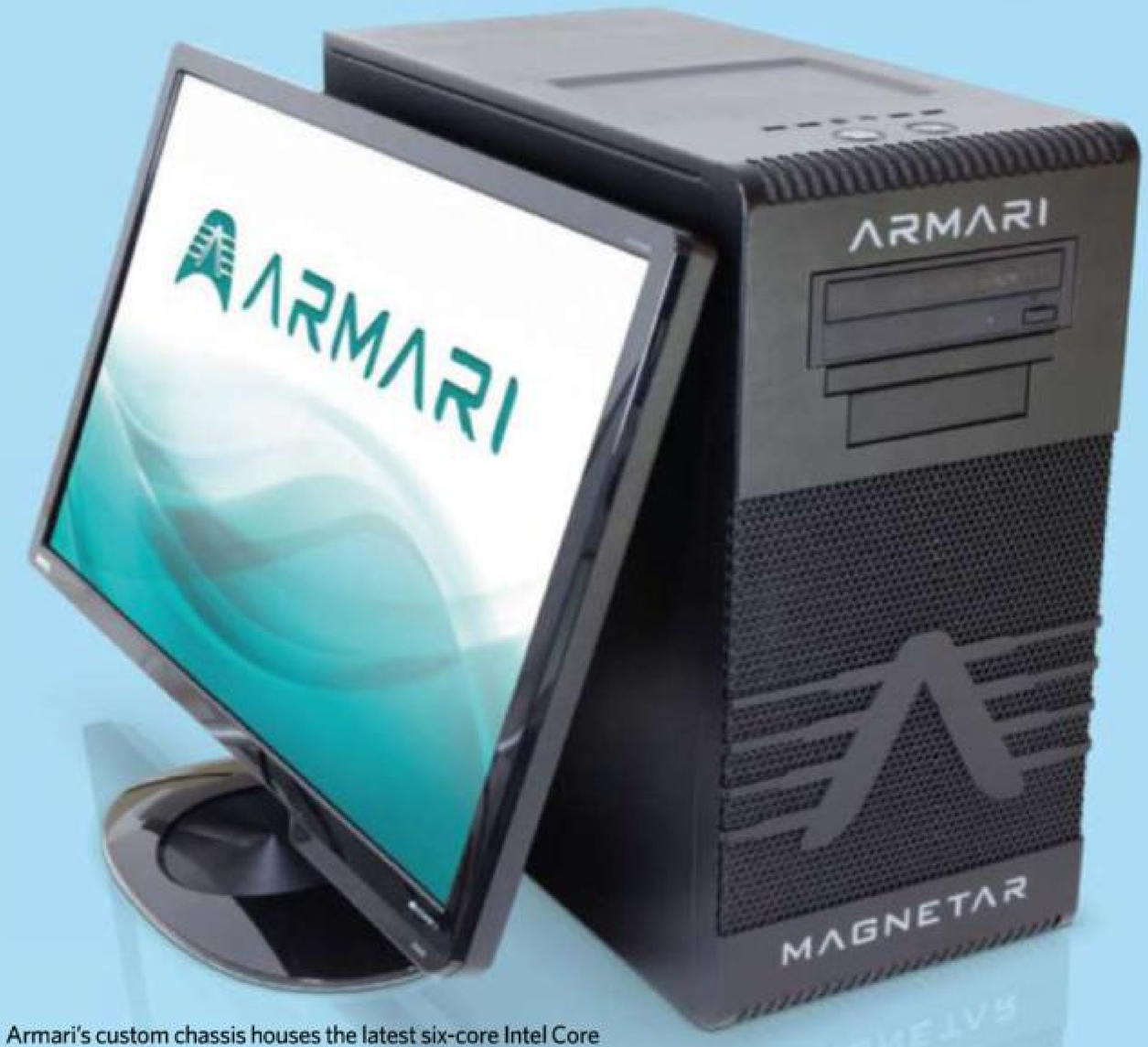


Armari's custom chassis houses the latest six-core Intel Core i7 processor, alongside a host of high-end components

Armari S16-AW750

The latest six-core Intel Core i7 makes the S16-AW750 great for modelling and a powerful 3D renderer

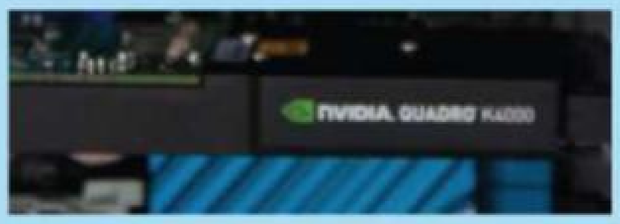
REVIEWS BY James Morris, technology writer, UK

Although Intel has just released a new processor generation called Haswell (see Chillblast Fusion Projection 2, p95), the six-core versions of the previous Ivy Bridge generation have only just arrived. Our first taste comes in the shape of an updated S16-AW750 from Armari, which we've previously reviewed (issue 54, p96).

The processor in question is Intel's Core i7-4930K, which runs at a nominal 3.4GHz and sports six physical cores that Intel's hyper-threading feature turns into 12 virtual cores. It also offers Turbo Boost, enabling a single core to hit 3.9GHz, although Armari has permanently enhanced the frequency to 4.5GHz across all cores. The Core i7 is backed by 32GB of 1,866MHz DDR3 SDRAM, supplied as four DIMMs to take full advantage of the processor's quad-channel memory architecture. This is also quicker than the 1,600MHz memory.

Unlike the original S16-AW750 we looked at, this model opts for AMD's graphics rather than NVIDIA's, in the form of a FirePro W7000, with a healthy 1,280 Stream Processors and a very sizeable 4GB of GDDR5 memory. Storage is the usual combination of a solid state disk for the operating system and applications, plus a conventional hard disk for data. The former is a 240GB Intel DC S3500, while the latter is the 2TB edition of Seagate's recently released Constellation CS 7,200rpm SATA drive. A Blu-ray reader and DVD-RW combo completes the storage specification.

The Ivy Bridge processor shows its prowess in the rendering portion of MAXON Cinebench R11.5. Its score of 13.62 is around nine per cent quicker than the previous S16-AW750 and is only surpassed by dual-socket systems such as Boston's Venom 2401-7T (see opposite page). The modelling story isn't quite so clear, as the AMD graphics has different strengths to NVIDIA's. The OpenGL score in Cinebench R11.5 of 104.69 is the second quickest we have ever seen and SPECviewperf results are generally excellent. However, the lightwave-01 score of 86.49 and maya-03 score of 90.32 are behind the previous model, while its SolidWorks sw-02 result of 79.13 is ahead. If you run LightWave or Maya, NVIDIA's Quadro K4000 or K5000 would provide far better 3D acceleration.



NVIDIA's Quadro K4000 is an alternative graphics option, which could be preferable for certain 3D content-creation applications

Essential info

Price: £2,290 ex VAT
$3,653 US*

www.armari.co.uk

OPERATING SYSTEMS

- Windows 7 Professional

SYSTEM SPECIFICATIONS

- 3.4GHz Intel Core i7-4930K enhanced to 4.5GHz
- 32GB 1,866MHz DDR3 SDRAM
- 4GB AMD FirePro W7000
- 120GB Samsung 840 SSD
- 240GB Intel DC S3500 SSD
- 2TB Seagate Constellation CS
- 7,200rpm SATA hard disk
- 18x LiteOn DH-4O3S-04-B DVD rewriter
- Windows 7 Professional 64-bit

As with many of Armari's workstations, water-cooling is used for the processor, which enables enhanced frequencies without excessive fan noise

The good & the bad

- ✓ **Fastest single-socket system we've seen**
- ✓ **Impressive overall modelling performance**
- ✓ **Great rendering times**
- ✓ **Healthy storage provision**
- ✗ **NVIDIA graphics are better for certain 3D animation applications**

Our verdict

Features	**8**/10
Ease of use	**10**/10
Quality of build	**10**/10
Value for money	**9**/10

"The S16-AW750 takes full advantage of the Core i7 to produce a great single-socket option for a large, yet reasonable price"

Final Score 9/10

*Price conversion correct at time of printing

Storemags.com

Boston Venom 2401-7T

A pair of the new version 2 Intel Xeon E5 processors makes the Venom 2401-7T the fastest 3D rendering system we've tested

At the same time as the six-core version of the Ivy Bridge Intel Core i7 has been released, the Ivy Bridge generation of the Xeon E5 has only just arrived as well.

So, to complement the Armari S16-AW750 this month, we bring you the Boston Venom 2401-7T. With a pair of the new version 2 Xeon E5 2687W processors, it's one of the most powerful systems we have ever seen.

Intel has made matters slightly confusing by giving the Xeon E5 2687W v2 the same name as the model it replaces, apart from the v2. This is still an eight-core processor, but whereas the previous version ran at a nominal 3.1GHz, the v2 increases this to 3.4GHz. The top Turbo Boost mode is now 4GHz rather than 3.8GHz, as well, but there's no change to the hyper-threading setup, which turns each real core into two virtual cores for the improved parallel-processing performance.

These potent processors are backed by a healthy 64GB of 1,866MHz DDR3 memory, which is an improvement over the 1,600MHz memory supported by the previous generation. The graphics are top-notch as well, with an NVIDIA Quadro K5000 partnered by an NVIDIA Tesla K20 CUDA co-processor. The K5000 sports 1,536 CUDA cores and 4GB of GDDR5 memory, while the Tesla card houses a whopping 2,496 CUDA cores and 5GB of GDDR5 memory. However, this can only be used for CUDA-powered parallel-processing tasks, such as rendering with compatible content-creation software, and it doesn't contribute to live modelling previews.

You'll find that storage is pretty standard for a 3D workstation, however. The 120GB SMART Storage CloudSpeed 500 SSD may be a little small for a system this powerful, but it is only meant to house the operating system and applications. Two 2TB Western Digital RE 7,200rpm SATA hard disks are provided for general project data and are configured as a RAID 1 mirror for security.

Not surprisingly, the Venom 2401-7T's two eight-core Xeons power it to the fastest rendering score we have ever seen in MAXON Cinebench R11.5. The result of 26.85 is almost twice as fast as the single-processor Armari S16-AW750. However, the Cinebench OpenGL test produces 50.34, which is adequate but nothing to write home about. In SPECviewperf 11, the lightwave-01 score of 75.51 and SolidWorks sw-02 score of 65.53 are impressive, although not as quick as the Armari's. In contrast, the maya-03 result of 114.22 is notably ahead, but not quite the fastest we have seen.

Behind this stylishly curved facade lurks a pair of the latest eight-core Xeon E5s, which pack an even bigger punch than the previous, very similarly named models

With a MAXON Cinebench R11.5 result of 26.85, the Venom 2401-7T is one of the most powerful rendering systems we've tested. This performance comes at a hefty price, though

Essential info

Price: £9,999 ex VAT
$16,162 US*

www.boston.co.uk

OPERATING SYSTEMS
- Windows 7 Professional

SYSTEM SPECIFICATIONS
- 2x 3.4GHz Intel Xeon E5-2687 v2
- 64GB 1866MHz ECC DDR3 SDRAM
- 4GB NVIDIA Quadro K5000
- 5GB NVIDIA Tesla K20
- 120GB SMART Storage CloudSpeed 500 SSD
- 2x 2TB Western Digital RE 7,200rpm SATA hard disk
- 7,200rpm SATA hard disk
- 12x Pioneer BDR-207MBK Blu-ray rewriter
- Windows 7 Professional 64-bit

The good & the bad

- ✓ The fastest rendering performance we've seen
- ✓ The Tesla card will provide unbeatable rendering with compatible software
- ✓ Good modelling results
- ✗ Extremely expensive
- ✗ Not as supreme in modelling as rendering

Our verdict

Features	9/10
Ease of use	10/10
Quality of build	10/10
Value for money	7/10

"A pricey system, but its rendering abilities are supreme, especially if you're using the NVIDIA Tesla card"

Final Score 9/10

Conclusion

Intel's new processors show great potential whether in single- or dual-socket form. The updated version of Armari's S16-AW750 comes in at an almost identical price to the previous model, yet offers faster rendering and great modelling, although you will want to specify the graphics brand that best suits the software you mainly use. As a modelling workstation, it's great value. If you need all-powerful rendering, though, the Boston Venom 2401-7T is in a different league and shows what two of the new Intel Xeon E5 version 2 processors can do. It's a pricey beast, but allied with a CUDA-enhanced rendering pipeline it provides supreme results.

*Price conversion correct at time of printing

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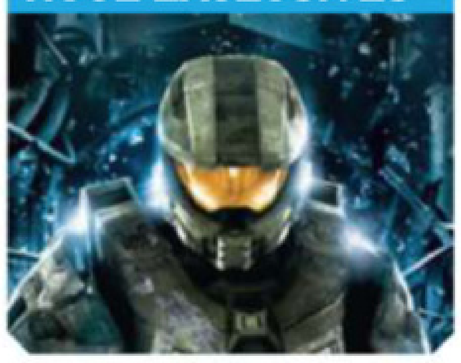

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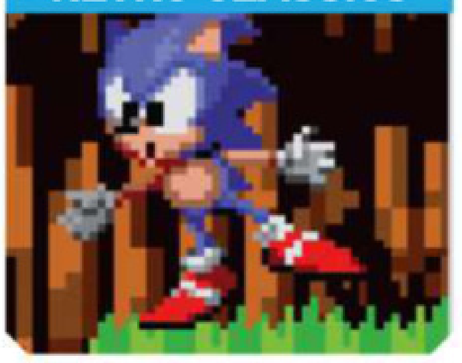

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Chillblast Fusion Projection 2

The Fusion Projection 2 harnesses the power of Intel's latest processor generation to give you more for your money

REVIEW BY James Morris, technology writer, UK

Workstations normally cost a couple of thousand pounds, so one costing just a little over one thousand might not seem like a serious proposition. However, Chillblast's Fusion Projection 2 has plenty of potential for the 3D content creator.

The Fusion Projection 2 has a new trick up its sleeve in the shape of a processor based on Intel's latest Haswell architecture. Chillblast keeps the costs down by using a Core i5 4670K, a quad-core CPU that runs at a nominal 3.4GHz with Turbo Boost on hand to increase a single core to 3.8GHz. This model also supports frequency enhancement, and Chillblast has taken advantage of this to permanently set all four cores to 4.2GHz. However, unlike a Core i7, the Core i5 doesn't support hyper-threading, so four physical cores is all you get.

The Core i5 is partnered with 16GB of 1,600MHz DDR3 SDRAM. We see quite a few single-socket workstations with twice this amount now, but 16GB will be adequate for most 3D content-creation tasks. To help keep costs down, Chillblast has also opted for NVIDIA Quadro K2000 graphics, which is a good balance between price and performance. It still sports 384 CUDA cores and a 2GB GDDR5 frame buffer, which puts it in on par with the previous-generation Quadro 4000.

Despite the budget orientation of this workstation, Chillblast has still managed to supply a dual-drive storage system. A 120GB Samsung 840 Series solid state disk is supplied for the operating system and applications, with a 1TB Seagate Barracuda 7200.14 7,200rpm conventional drive for general data. Neither are huge, but will be enough for an entry-level content creator.

The Chillblast Fusion Projection 2 is well presented and sports a sturdy case in-keeping with high-end machines

With just four cores and no hyper-threading, the Chillblast wasn't going to match Armari's six-core Magnetar S16-AW750 (see p92) for brute CPU performance, but it still does pretty well, with a result of 7.12 in the rendering portion of MAXON Cinebench R11.5. Likewise, its NVIDIA Quadro K2000 graphics provide a mid-range result of 61.35 in the OpenGL portion of Cinebench R11.5. Results in SPECviewperf are decidedly impressive. The lightwave-01 score of 94.92 is one of the best and the maya-03 result of 88.71 is excellent too, but 59.44 in the SolidWorks sw-02 viewset is merely adequate.

The Chillblast Fusion Projection 2 may not be about to give premium single-socket systems such as Armari's S16-AW750 (p92) too much to worry about, but it is half the price. The modelling and rendering abilities will be more than adequate for a student or 3D artist on a budget, without significant compromise in any stage of the production pipeline.

The Chillblast Fusion Projection 2 brings together a sensible collection of cutting-edge components to make a balanced budget workstation

Essential info

Price: £1,041 ex VAT**/$1,679 US***
www.chillblast.com

OPERATING SYSTEMS
- Windows 7 Professional

SYSTEM SPECIFICATIONS
- 3.4GHz Intel Core i5-4650K enhanced to 4.2GHz
- 16GB 1,600MHz DDR3 SDRAM
- 2GB NVIDIA Quadro K2000
- 120GB Samsung 840 Series Solid State Disk
- 1TB Seagate Barracuda 7200.14 7,200rpm SATA hard disk
- 24x Sony DVD rewriter
- Multi-format memory card reader
- Windows 7 Professional 64-bit
- Warranty: two-year collect and return

Ideal for those just starting out in the world of CG, the Chillblast Fusion Projection 2 packs a considerable feature set and gives great results that far outweigh its modest price

The good & the bad

- ✓ Great value
- ✓ Decent rendering results
- ✓ Competitive modelling results for this bracket
- ✓ Well-balanced specification
- ✗ Merely adequate storage

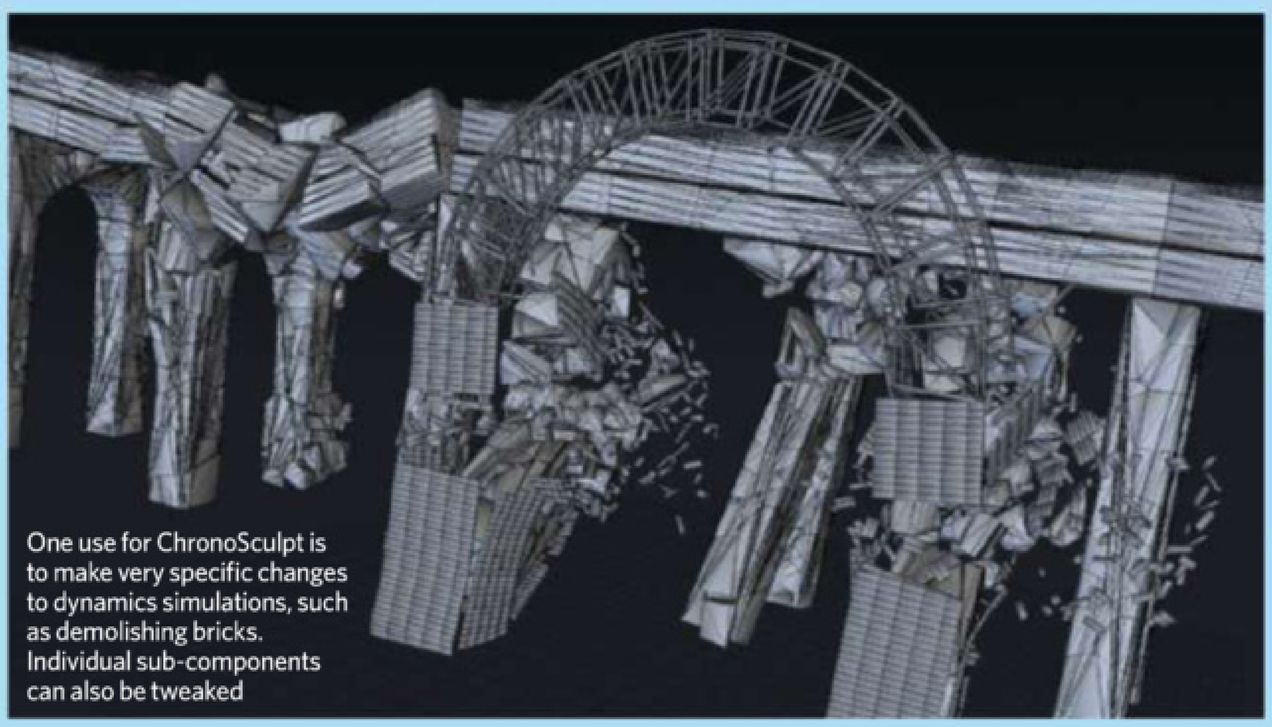
Our verdict

Features	7/10
Ease of use	10/10
Quality of build	9/10
Value for money	9/10

"Good modelling and rendering performance for a modest price tag make this a great-value workstation"

Final Score 9/10

*Price conversion correct at time of printing



One use for ChronoSculpt is to make very specific changes to dynamics simulations, such as demolishing bricks. Individual sub-components can also be tweaked

ChronoSculpt (pre-release 1.0)

NewTek now offers the power to retrospectively control time and repair broken simulations

REVIEW BY Craig A. Clark, freelance CG modeller, UK

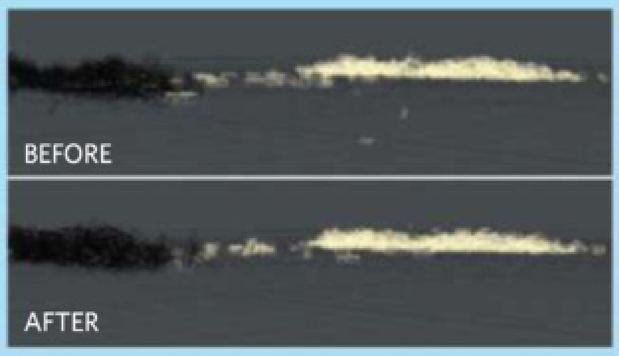
One of the all-time cool things in the 3D software world is dynamics. We all love to see the movement, interaction and inertia of objects in 3D space, whether that's bouncing, bending, twisting or smashing. The problem is that such simulations don't always work correctly. This is never truer than when dealing with geometry being smashed and dispersed. Each fragment, shard, or block is calculated, accounting for its interaction with other fragments and the ground. This is no small task for software to calculate and I can personally forgive odd occasions when the calculations create a glitch in the simulation.

However, with ChronoSculpt such issues are less of a concern. When testing the software, I modelled three brick walls and promptly knocked them all down with a motor vehicle. My dynamics simulation was by no means totally realistic, but it looked okay. The problem was that, as the bricks bounced and tumbled, several managed to break through the ground. I know that LW11's Bullet Physics would have handled this fine if I gave the ground plane some thickness, but for this review I was happy to encourage a glitch.

Having run the simulation, I exported the calculated result by saving the MDD file for each of my wall model layers. I simply loaded my LightWave model into ChronoSculpt, then selected each layer in turn and loaded the corresponding MDD file. In the case of my scene, I could then use the Transform and Pin tools to select and constrain the individual bricks that dropped through the floor, keeping them on the ground. Once I had them all accounted for, I selected each model layer in turn and saved out the new MDD files.

Back in Layout, I used the Multi-MDD importer to read in the three new MDDs and assigned them to the correct model layers. That was all it took to get my wayward bricks behaving again. This is just one of the uses for ChronoSculpt – you can actually deform geometry over time and use the MDD or other export options to apply the deformations in Layout.

Its pretty powerful stuff, but it's not without issues. The interface is not very intuitive or visually pleasing, looking somewhat thrown together. Nevertheless, it can't be overlooked that this review is of the pre-release version of ChronoSculpt, so there may be improvements and additions before the Q4 shipping. As it stands, this is an exciting first version of ChronoSculpt, demonstrating the potential to transform the way we approach post-production tweaks in the future.



Before and after in Layout, showing the bricks that had fallen through the floor and the resulting fix with ChronoSculpt using the updated MDD files

Essential info

Price: $399 US / £250*

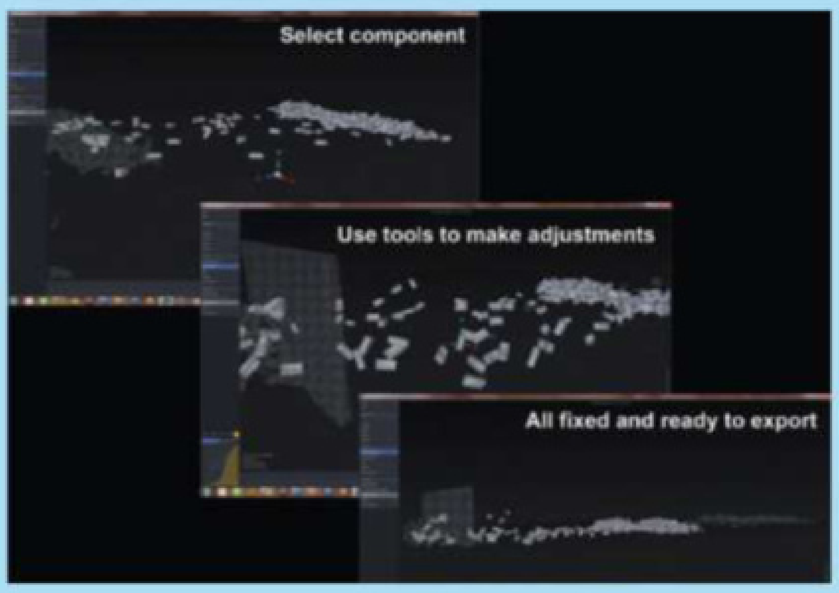
www.lightwave3d.com/chronosculpt

OPERATING SYSTEMS

- Windows Vista & 7/8 64-bit
- Mac OSX Snow Leopard 10.6+

OPTIMAL SYSTEM REQUIREMENTS

- Intel Core 2 or AMD Athlon II Processor or better (Windows)
- Intel Processor (Mac OS)
- 64-bit System RAM: 4GB minimum
- 300MB available hard drive space with sample projects approximately 750MB



It's a pretty straightforward process of picking the tool and then selecting the piece of geometry that you wish to be affected by it

The good & the bad

- ✓ Simple workflow
- ✓ Near seamless integration with LightWave
- ✓ A quick and responsive on-screen display
- ✓ Very modest minimum hardware requirements
- ✓ Competitive pricing
- ✗ Feels rough and unpolished when compared to LightWave
- ✗ NewTek support could be improved slightly

Our verdict

Features	8/10
Ease of use	7/10
Quality of results	8/10
Value for money	8/10

> Still unfinished, but an exciting new product with the potential to become an amazing tool

Final Score 8/10

*Price conversion correct at time of printing

iClone Pro 5.5

Reallusion expands its animation credentials with Motion Plus, Mix Moves, enhanced Height Map Terrains and more

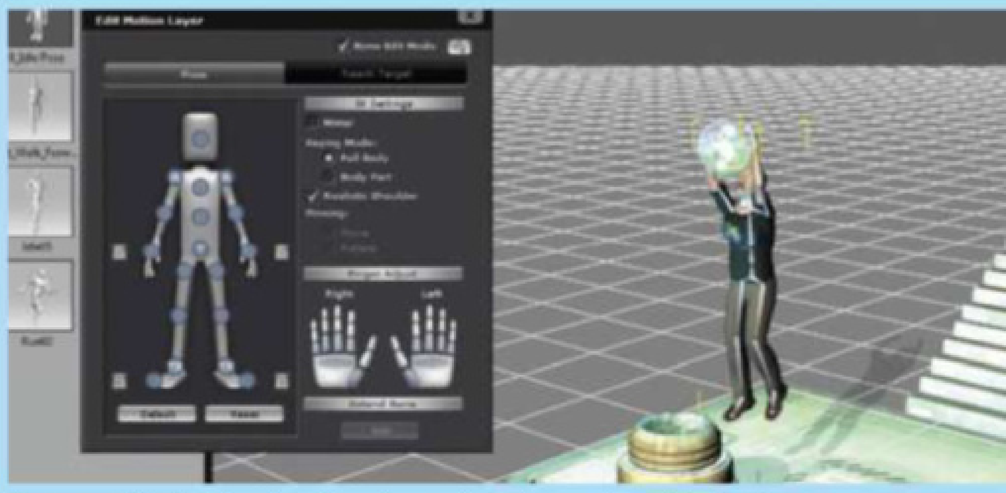
REVIEW BY Alan Marques, freelance VFX supervisor and digital artist, UK

Reallusion's iClone has reached version 5.5. For those of us long-time users who have been asking for it repeatedly, the biggest feature for this release is the availability of a 64-bit version of iClone that now enables access to more than 3GB of RAM on your system, resulting in much larger-scale scenes. To access this version you will need to download the full installer and not patch your current 32-bit version.

As Reallusion focuses on having iClone talk to major 3D applications – such as Maya for final rendering, as well as Unity for games work facilitated by its 3DxChange Pipeline product – it has become key to improve iClone's animation credentials. A quick hunt of the Animation menu reveals an all-new option called Motion Plus. Quite simply this has extended the Collect Tracks feature to now include all of the animation parameters for an entire character. You can save a new animation clip that contains face and dialog, spring effects, as well as Reach Targets when pinning or pointing hands and feet. I found myself able to save complex animations with ease and then apply that clip to any other iClone avatar. The only caveat I found with this new feature was with more complex animations. I had my character reach for and grip onto a floating orb, which then lifted the entire character's body off the ground. When I saved this entire animation, including face and dialog, I found when I applied it to a character with different body proportions the hands drifted away from their contact with the orb. This was easy enough to fix using the Edit Motion Layer panel to animate them back into contact, but it does mean you have to be careful with complex contact-based animation, as it's not fool-proof and requires plenty of post-production when reusing. Nevertheless, when working on general animation it's a great feature.

Height Map Terrains have been enhanced, enabling larger sizes and the ability to complete basic editing. The Height map and mask can now be loaded into your favourite paint applications and there are slider controls for adjusting Height, Offset and Smoothing. If Terrain Physics are enabled there are controls for Collision Margin, Friction and Elasticity, which help improve surface interaction with vehicles and props.

Overall, iClone 5.5 is deservedly king of real-time animation and is my tool of choice for machinima and pre-visualisation.



To test out Motion Plus the orb and avatar have been animated using the Edit Motion Panel and HumanIK along with the Reach Target feature

The Collect Clip feature has now been expanded. With the entire timeline selected, Motion Plus will save animation, dialog, sound and Reach Target data

The new Motion Plus feature is put to test in this iClone scene, to check out Reach Targeting and the saving of full animation data

Essential info

Price: $200 US / £125*

www.reallusion.com

OPERATING SYSTEMS

- Windows 8 / 7 / Vista / XP SP2 32-bit and 64-bit

OPTIMAL SYSTEM REQUIREMENTS

- Dual Core CPU or Higher
- 2GB RAM
- 2GB free hard drive space
- NVIDIA GeForce 8 Series or higher / ATI HD 300 Series or Higher
- 512 Graphics RAM or Higher
- Pixel Shader 3.0 recommended

The good & the bad

- ✓ A comprehensive real-time animation tool
- ✓ Supports Microsoft Kinect for mocap (requires additional purchase)
- ✓ Fast animation with the Puppet tool and HumanIK
- ✓ Extensive real-time atmospheric effects
- ✓ Soft- and hard-body physics
- ✗ Cannot disable the auto keying feature
- ✗ Animation transitions can be prone to glitches
- ✗ Reach Targets can cause issues with Motion Plus
- ✗ No real-world camera backs and lenses

Our verdict

Features	8/10
Ease of use	9/10
Quality of product	8/10
Value for money	9/10

"If you are into real-time 3D machinima movies or pre-visualisation, iClone is still in a league of its own"

Final Score 9/10

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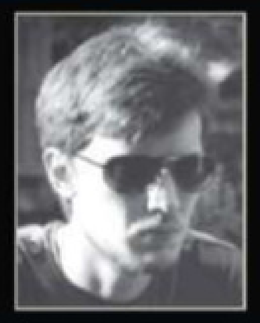
Artist info



Anton Turkin

Website www.zwill.pro
Country Russia
Software used 3ds Max, ZBrush, Photoshop
Bio Anton has been working with CG both as a hobby and for professional work since 2004

Gagarin 2013

In my childhood I spent most of my school holidays in the countryside. Every summer my granddad and I would take a train and travel far away from the big city. This image was inspired by these trips.

> Special attention was paid to textures and materials so it would look like it had just rained. Post-production was completed in Photoshop in order to decisively add mood and atmosphere to the image

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RenPeng Dong

Personal portfolio site
www.oldrhyme.cgsociety.org
Country China
Software used
3ds Max, Maya, ZBrush, Mudbox, Photoshop, V-Ray

"I saw an image on a website that was like a kind of transparent man blending with his background, which brought me this great idea... [I] decided to show the feeling of part drying paint, part real, part plaster"

Non-US readers turn to page 90

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3D Artist

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102 News

Industry news

We speak to the team behind BFX to discover what happened after the festival

104 Studio access

Squeeze Studio

The animation studio discusses its focus on best-quality, totally keyframed character animation

106 Project focus

CD Projekt RED

The Polish studio reveals its next-gen creation: open-world fantasy *The Witcher 3: Wild Hunt*

108 Industry insider

Pavel Dorokhovsky

4A Games' Pavel Dorokhovsky takes us into the world of game character creation

111 Course focus

MA Games Art

Train for a senior career in the games industry at the University of Hertfordshire

inside

> We wanted to keep the unique feel of The Witcher 2 and have it applied to a much larger scale

Jonas Mattson environment artist, CD Projekt RED. Page 106

The Witcher 3 Ice Giant Character Render

Two of the amazing artists behind *The Witcher 3: Wild Hunt* reveal how the open-world fantasy game is the biggest and best of the trilogy

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The first BFX Festival took place in Bournemouth from the 25 to 29 September, including events such as screenings, masterclasses and an awards ceremony for students who took part in the summer competition

Post-BFX

BFX competition and festival director Sofronis Efstathiou on the successes of the inaugural event

"Scheduling was crazy at times, I now appreciate the job of an events manager!" reveals Efstathiou. The festival, as well as the student competition, will be returning in 2014

Did you expect such a successful event and competition when you first began organising the festival years ago?
We were very lucky to have attracted some of the best studios from around the world. At the same time, the BFX competitors were fantastic – many had just completed their second- and third-year exams at university, yet still found the time to create a ten-minute pitch as part of the competition's shortlisting process. Once shortlisted, the teams worked for a further six weeks in a very intense and competitive environment, producing some truly astonishing work considering the limited resources and time given to them. When I think back, it was the competition that worried me the most – it was the first of its kind in the UK, so we had no idea what the students and industry studios would be able to create. Luckily for us, the results were amazing.

What aspects would you improve or keep the same for next year's festival?
I would love to add more talks and events around entrepreneurship and developing or protecting IP. Our concept art exhibition will be getting bigger – some beautiful work was on display during the festival and in the future we would love to continue to house and maybe even travel across the UK with a collection of work that is rarely seen outside our field of study. We are also looking to create an academic conference within the fields of computer animation and visual effects that will sit within BFX itself, connecting the conference to a number of related journals in our field. [We also want to] incorporate more masterclasses from the best artists found in the industry, including technical workshops for the technical artist or director within us. With regards to the competition, I would love to have an extra week or two, so teams have time to settle in before starting the project work

What have the students gained in terms of scholarships through their work?
Three students received fully paid scholarships to join Masters programs at the Arts University Bournemouth and NCCA at Bournemouth University. One competitor was offered a short-term contract on a commercial the following weekend. Collectively, studios involved in the competition are also in the process of offering between six and eight internships. The highest compliment I can give the BFX teams was that a creative director, after seeing the work produced, compared it to a commercial project – which would have cost hundreds of thousands of pounds to create. He stood up and rang his studio to make sure they were contacting the teams involved. I think that's a great endorsement of what we achieved.

Image from the final competition short produced by Team Wizard, which won Best Editing and Best Animation

Stemmingsa

● **HAVE YOU HEARD?** • Autodesk has announced that it's investing in the online art community, DeviantART

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Caustic Graphics releases new Visualizer

Visualizer for Maya 1.2 aims to reduce and even eliminate time-consuming test renders

Developed to enable artists to create images without the need to test renders, the new release will contain further updates as well as performance improvements and bug fixes. Features such as accurate soft shadows, diffuse reflections and translucency can now also be viewed in real-time with viewport raytracing.

Visualizer for Maya 1.2 will include highlights such as support for Alpha channels – for final-render views for Maya 2013 and 2014 editions – and final-render motion blur support that can be defined either per-camera or for all cameras using the global settings. Viewport rendering is not motion-blurred to ensure compatibility with Maya's non-blurring wireframe UIs.

The latest version of Visualizer looks to speed up and optimise the look-development process even further

To discover how Visualizer can enhance your workflow, you can download a trial for the plug-in via **https://support.caustic.com/downloads**. You can also navigate to this page from the main Caustic site **https://caustic.com**. Caustic Visualizer for Maya is normally priced at around $299.

Software shorts

Bringing you the lowdown on product updates and launches

Frax

Computer graphics veterans Ben Weiss and Kai Krause have released Frax, a new iOS app that generates real-time fractal landscapes and enables users to adjust 3D parameters to control the results. Frax comes in a standard edition that costs $1.99 and an HD edition for iPad only, which costs $3.99. For more information and to get your copy, visit **http://fract.al**.

MASH 2.2 for Maya

MASH is an entirely procedural suite of 24 Maya nodes developed in-house at creative production studio Mainframe, aimed at enabling artists to create versatile motion design-style animations. It offers a selection of effector nodes to generate customisable effects. The new 2.2 release is available to download as a trial for free, or £90 for the full version. Visit **http://mash.mainframe.co.uk** for more.

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Studio Access

Squeeze Studio

The Canadian company discusses its complete focus on keyframed character animation and how quality always comes first

A

Patrick Beaulieu and I shared the same vision for the studio," states Denis Doré, co-founder of Squeeze Studio Animation. "Our goal was to stay focused on one precise objective: to create world-class animated content, here in Quebec City. No compromise on quality."

Two years later their aim of achieving the highest-quality animation still stands strong, with the studio keyframing both its original creations and its 3D animation projects for clients by hand. "We see each character as an actor. Our job is to bring it to life, to make sure its personality shines and to leave an unforgettable impression on the viewer," continues Doré. "All of our animators are artists. They aren't looking to re-create reality with perfection. They are looking to create a performance, a representation of reality without the need for it to be perfect. Keyframe animation gives the animator the freedom to do this, enabling him/her to push poses to the extremes, bending the laws of nature if needed."

Squeeze's perfectionist approach means the animation team will usually begin production for a project by re-creating their concept through stop motion, puppets, 2D animation, or live-action, before letting a client watch this first draft and give feedback. This enables the intentions of each shot to be completely clear before even beginning to move on to 3D. Though this approach might appear lengthy, Doré explains that it actually saves the studio time, as was the case with its recent work on 80 animation shots for *The Avengers: Battle for Earth*. The animators began by renting superhero costumes, filming themselves re-creating their shots with them on, and finally adding 2D effects to the results before sending them to partners at Ubisoft and Marvel. "They could see exactly where we were going and share comments. All the shots but two were approved the first time around," continues Doré. "Within a week we could start to animate in 3D, which meant extra time and money could be spent where it matters most: pushing quality to the top."

Interestingly, the studio also creates 3D characters with their own unique personalities as a service to brands, allowing these original creations to be sold or even rented out for commercials, games, feature films and even animated books. "Patrick started designing characters many years ago, several of them being featured around the world in magazines, websites and

> "From day one we made the decision to build a studio focused on high-end animation and not on the price. Our team, and what potential clients think of our work, is what really matters in the end"
>
> **Denis Doré, co-founder of Squeeze Studio**

SQUEEZE studio animation

Squeeze Studio specialises in creating world-class 3D animation. Its mission: to breathe life into unforgettable characters. Co-founded in 2011 by Patrick Beaulieu and Denis Doré in Quebec City, Squeeze develops its own original creations while also providing unique 3D animation services to the videogame, film and television industries.

www.squeezestudio.com

Country Canada

Software used 3ds Max (modelling, texturing and shading), Photoshop (texturing and shading), Maya (rigging and animation), EyeOn Fusion (compositing), Toonboom Harmony (planning - 2D effects), Shotgun (task-management software)

Contributors

Denis Doré
Co-founder, business development director

Patrick Beaulieu
Co-founder, creative director

Portfolio highlights

Here are some of the big budget projects Squeeze Studio has worked on:

2013 Productions Thalie, *Dragons: 3D Real Myths, Unreal Creatures*, Imax 3D movie
2013 Brand33, *MRI Black Powder Ultra*, anime, TV spot
2012 Ubisoft-Marvel, *The Avengers: Battle for Earth*, videogame
2011 Ubisoft, *Assassin's Creed: Revelations*, videogame
2009-2011 Ubisoft, *Combat of Giants*, videogame series
2009 Ubisoft, *Prince of Persia: The Forgotten Sands*, videogame
2008 Activision-Beenox, *Monsters vs Aliens*, videogame
2007 Ubisoft, *Tom Clancy's Rainbow Six: Vegas*, videogame
2006 Hybride, *Snakes on a Plane*, feature film
2005 Hybride, *Sin City*, feature film

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New directions

Doré discusses the path the studio is taking for the future as the team moves into a bigger studio

Despite being formed just a few years ago, Doré tells us Squeeze is in the process of moving into a brand-new space that's triple the size of its current location, and is already working on high-profile projects such as a video cinematic, where the team pushed themselves in a more realistic direction. "But this is not to say that we are leaving cartoon characters behind," he emphasises. "No way! A very funny game cinematic is also currently in the making, as well as a short film and a series of animated books."

so on," explains Doré. "I guess we can say they are already a part of Squeeze's signature."

For Doré, it's an exciting time for any CG artist. "As a small studio, waiting to be noticed by a feature film or videogame producer is not always an easy task. Luckily, the industry is entering a very exciting era. The explosion of mobile devices and online channels is growing communities that make it possible for small studios to become producers themselves. It's a new way to build awareness of a character and transform it into a real brand."

A "Characters are the key to creating a strong connection with the viewers, be it in a movie, a videogame or a television commercial. They must be appealing, unique and interesting," Doré explains

B "We always try to bring a special flavour to our work; Squeeze's distinctive signature," explains Doré. "Starting from there, our first move is to work on the concept and push it as far as we can!"

C "After meeting with people from Rovio last December, we thought it would be fun to try to bring their famous *Angry Birds* into 3D," says Doré. The team strived to retain the aesthetic of the original

D Squeeze Studio works on both existing characters and its own, such as *Fernutz the Dancing Farmer*, which the team made using animation for an Android live wallpaper and other apps

E The studio has recently begun to explore more realistic imagery in its work, animating live-action-ready dragons for the *Dragons: Real Myths, Unreal Creatures* 3D Imax movie recently released

Project Focus

Witcher 3: Wild Hunt

The next-gen, open-world fantasy RPG that promises a mature, novel-quality narrative

CDPROJEKT:

Project *The Witcher 3: Wild Hunt*

Description *The Witcher 3: Wild Hunt* presents a unique combination of non-linear storytelling in an open world – a fantasy RPG focused on player choice, tactical combat and an immersive environment. Spinning the tale of Geralt of Rivia, a professional monster hunter, *The Witcher 3* aims to attract gamers with a mature and compelling game narrative told as no other has been told before

Company CD Projekt RED

Country Poland

Bio Established in 2002, CD Projekt RED is the creator of *The Witcher* and *The Witcher 2: Assassins of Kings* – RPGs praised by critics and fans that gathered over 200 awards and sold over 5 million copies to-date. Originally a PC developer, CD Projekt RED has released *The Witcher* on Mac and *The Witcher 2* both on the Xbox 360 and Mac. The studio is now working on *The Witcher 3: Wild Hunt* and *Cyberpunk 2077*

Website
www.cdprojekt.com
www.cdpred.com

***The Witcher 3: Wild Hunt* has certainly received a significant amount of admiration.** During E3 alone the game received more than 50 awards, ranging from the Least Likely to be Absolute Arse Award to its many, perhaps more serious, Best of E3 accolades – despite the fact that CD Projekt RED was still working on the game at the time.

When approaching the final instalment of the series, the development team aimed to further explore their renowned ability for complex RPG mechanics and inventive narrative. In order to do this they decided to introduce a huge open-world environment to the game. "We wanted to keep the unique feel of *The Witcher 2* and have it applied to a much larger scale," begins environment artist Jonas Mattson. "We want to really wow people and, due to the technical restraints in the earlier two games, we haven't been able to do open world until now. This time around we are making *The Witcher* game that we always wanted to make."

For Mattson, the most challenging aspect of developing the game was to create its authentic open world – which will be 30 times bigger than *The Witcher 2* – without using generic assets. "It was important to us that everything made sense – sure, it's a fantasy game, but we wanted to give the player a sense that it could actually be real," he explains. "The main problem we faced was memory and how to keep it under budget, so our programmers created a new streaming system that doesn't intrude into the artists' work. After a lot of research we found that the best way would be to have more tiled textures and be clever about what those textures were." He also tells us that, aside from certain unique objects, the majority of the textures in the game were implemented in this way. "Thanks to our shaders, we could change the colour of a brick texture so the bricks look brand-new or really worn, without increasing the texture budget."

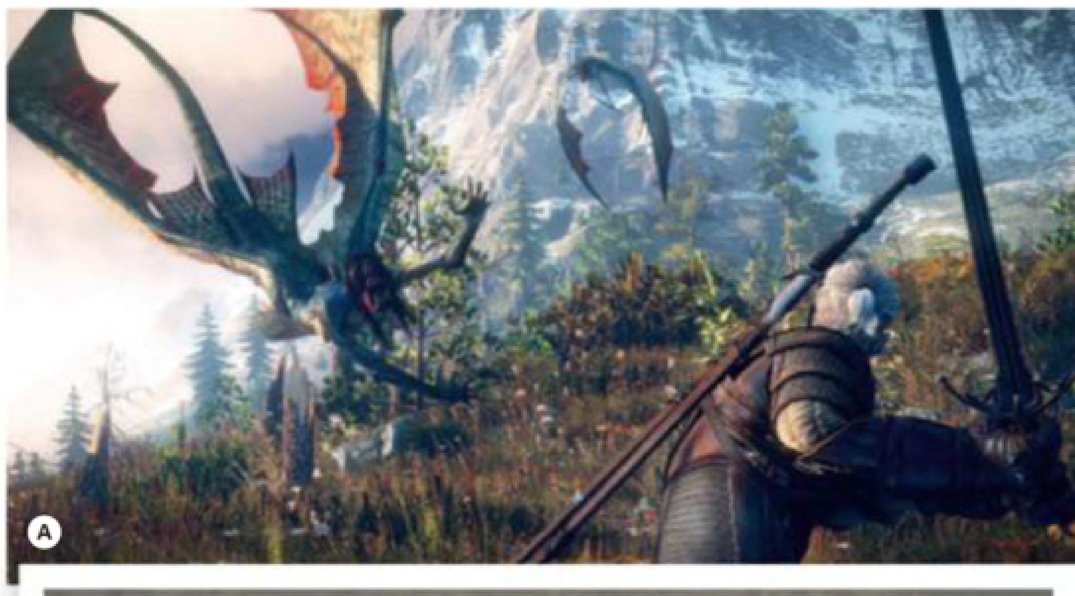
"My biggest challenge while working on *The Witcher 3* project was to design the facial expressions system from scratch," reveals lead character artist Paweł Mielniczuk. "In a game as big as ours, where core character numbers reach well above 50 and side characters go into the hundreds, every one of them has to have a fully functional and plausible facial

> "It feels great to know that all that hard work is paying off. We spent a lot of time working on the game, yet it's hard to predict what the reaction will be when you show it to people"
> **Jonas Mattson,** environment artist

Contributors

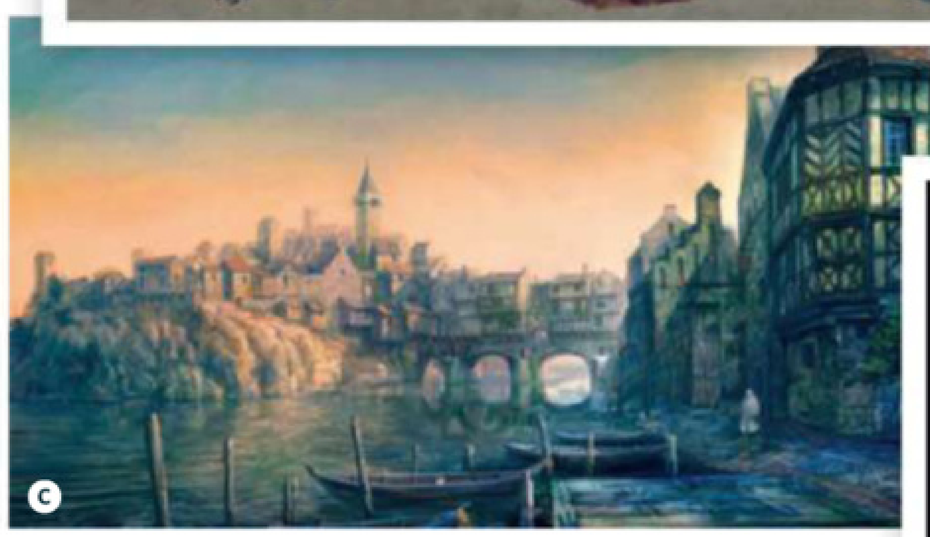
Jonas Mattson
Environment artist

Paweł Mielniczuk
Lead character artist

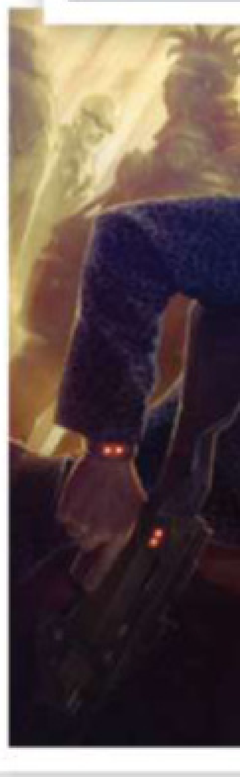


A *The Witcher 3* features REDengine 3, the new game engine created for non-linear RPGs. "Game editors have, historically, always been a bit tricky to work with. Now, with the REDengine, it's really easy for an artist to create a level," says Mattson

B The facial expressions in game had to be plausible and fully functional even for the many hundreds of NPC characters. CD Projekt's impressive pre-rendered facial animation, meanwhile, can be seen in the recently released cinematic trailer



C Development on *The Witcher 3* commenced with copious amounts of research into the various themes, colours and moods required. Real-world medieval cities were studied to provide reference for both their authentic aesthetic as well as their layout



Portfolio highlights

Here are some of the big projects CD Projekt RED has worked on:

2012 *The Witcher 2: Assassins of Kings* (Mac)
2012 *The Witcher: Enhanced Edition* (Mac)
2012 *The Witcher 2: Assassins of Kings Enhanced Edition* (PC, Xbox 360)
2011 *The Witcher 2: Assassins of Kings* (PC)
2008 *The Witcher: Enhanced Edition* (PC)
2007 *The Witcher* (PC)

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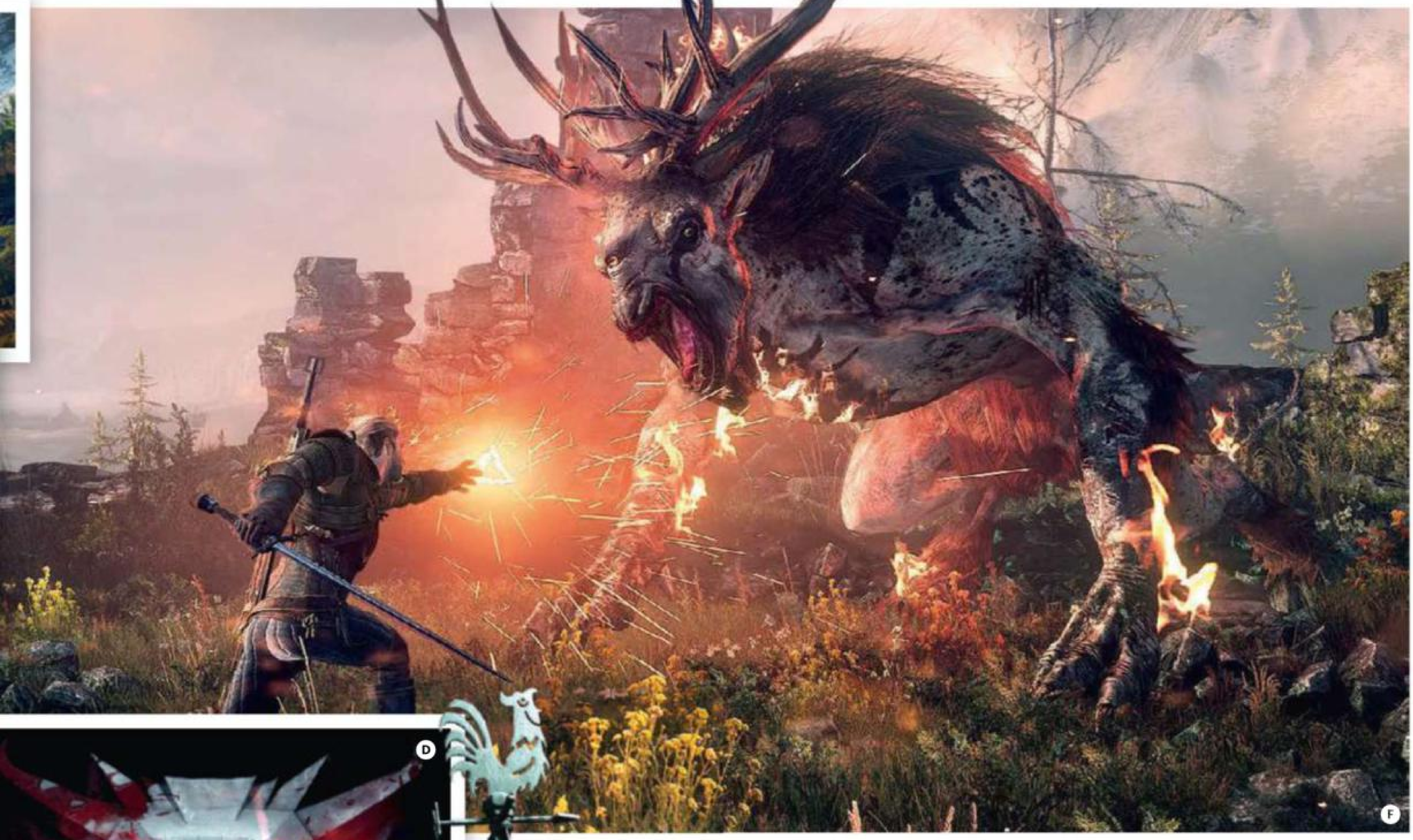

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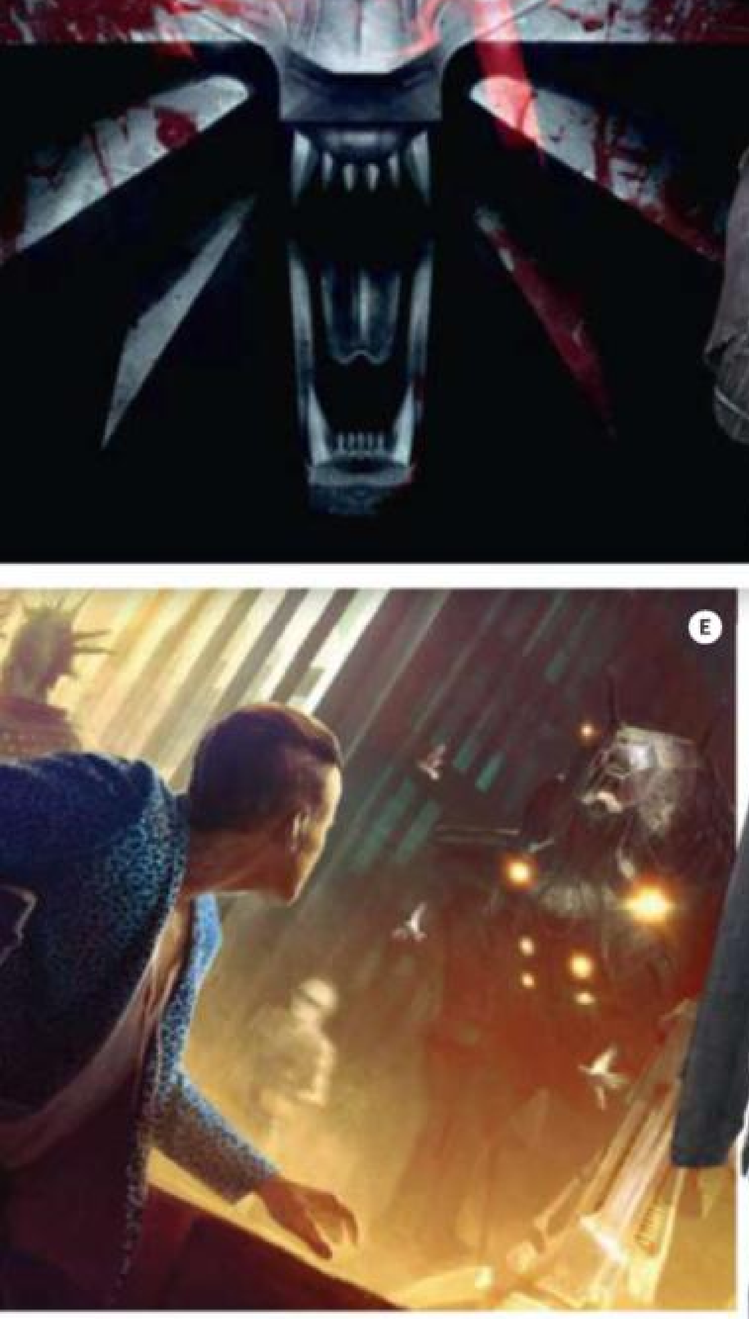

E

The importance of joining objects

Jonas Mattson describes CD Projekt RED's workflow during the production of The Witcher 3 and its impressive cinematic trailer

"First we model the mesh in 3ds Max and create the Normal map using either ZBrush or CrazyBump, depending on what kind of texture we are creating. For trees and vegetation, we use SpeedTree," Mattson says. "Then, when we have all the assets we need, we start placing them in the editor, adding extra lights and/or particles...

"The connection between objects is something that's extremely important to us," he says. "Imagine a stone foundation that then connects to mossy rocks, that then connects with foliage – a lot of work is needed to make everything seem natural."

animation system to act out all the emotions needed in a scene." He explains that every head had to be as polished as that of the main character. This is yet another example of the attention to detail being shown over the course of the production, for everything from the tiled textures to the mood and lighting of each scene, which had its own dedicated group of artists.

All of this just goes to show what can be achieved when a developer approaches game design with a simple aim: to make a game that they want to play themselves. "There's this primal passion for making games at RED – ideas aren't bogged down in a puddle of corporate decisions," concludes Mattson. "We want to make the best RPGs on earth and each year brings us closer to achieving this goal!"

D CD Projekt RED has recently entered the last stretch of development on the game, with a planned release for 2014. The studio has already accumulated more than 200 awards for its previous *The Witcher* titles – praised for their complex RPG narratives

E CD Projekt RED has also announced the opening of a new studio in Krakow to bolster the development of *The Witcher 3* and the studio's next RPG, *Cyberpunk 2077*. Featuring a corrupt futuristic setting, a teaser trailer was recently released

F "The lighting is a really big deal for us – you can have assets that look great on their own, but in-game poor lighting will ruin the effect," explains Mattson. As such, the team was dedicated to achieving the utmost detail in every object it created

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Industry insider

Pavel Dorokhovsky

Lead character artist at 4A Games

We talk with Pavel Dorokhovsky about his journey to becoming lead character artist at 4A Games and why it's the best studio he's worked at

About the insider

Job Lead character artist
Location Kiev, Ukraine
Education Kung fu
Company website http://sandviper.cghub.com
Biography Dorokhovsky is a lead character artist at 4A Games with eight years of experience working in the games industry. He most recently worked on the new characters in *Metro: Last Light* in collaboration with studio concept artist Vlad Tkach.

It's the year 2034, and the last remains of humanity have managed to eke out one more year of survival within the underground tunnels of what was once Moscow's metro system – despite the deadly mutants that still roam the remains of the city above.

This is the fascinating universe of *Metro: Last Light*, the horror videogame sequel developed by Ukrainian studio 4A Games and inspired by the internationally acclaimed series of novels by Dmitry Glukhovsky, who notably collaborated with the developers to produce the sequel's storyline and dialogue.

As lead character artist at the studio, it was Pavel Dorokhovsky's job to work alongside 4A's concept artist Vlad Tkach to create over 50 brand-new characters and creatures. "We argued a lot about how our characters should look," Dorokhovsky reveals. "This was not just a restyling of classic monsters and people. We used a lot of references and didn't have to search for them for long... you just need to look out on the street and see the real world! We wanted anyone who sees the new characters to say 'Oh yeah I know them, they are from Metro LL'. I hope that we succeeded."

Can you please tell us about how you first got involved with the world of 3D games art?
I always loved traditional art and I always adored gaming, so as you can see I had no choice! It was only a matter of time. I went to learn 3D modelling in 2006 and after two months I started to work for Persha Studio, but that was not what I was expecting so I quit and stayed home to improve my artistic skills.

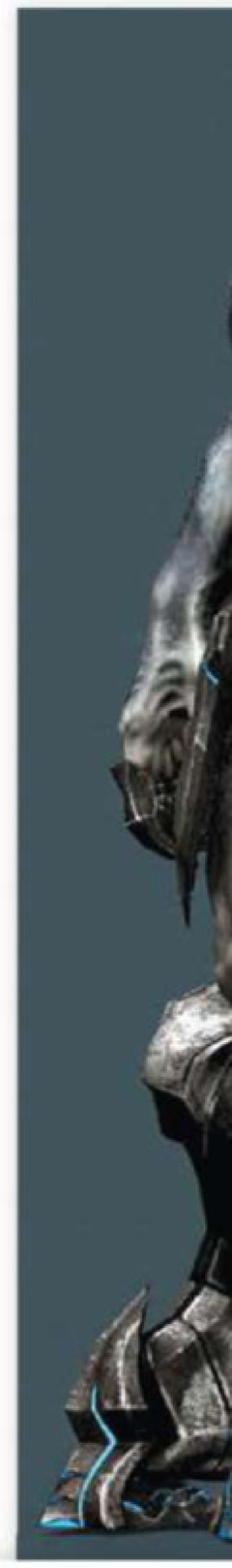
What led you to work for 4A Games?
I was very lucky because 4A Games is the best of all the companies I have worked with. I know it sounds too good to be true, but last year I refused at least 20 companies who contacted me to offer employment.

In the Ukraine, as well as in Russia, many artists tend to leave their homeland and move to another country after reaching a certain level. It's really awesome when you want to progress to improve your skills, but when you leave for material benefits, this is totally wrong! I'm not saying that I'm good and they are bad, but I will only come to work for a company if the project is really interesting for me. When you see and feel how valuable your contribution is to the project, that is the strongest motivation of all.

The financial aspect of a job is also very important, but if you don't like what you do, if you can't wait for your next weekend, you are doing the wrong job. That's why I refused all who were interested in me as an artist, because I strongly believe I'm working in one of the best studios in the world, in a great team, on projects that I love! What could be better than this?

What advice would you give to a budding artist looking to be a successful 3D games character artist?
You need to love art, games and be a kid at heart. You have to work very hard and practise every day. Everything comes with experience and if you didn't do it the first time, don't worry, just start over again.

What is one insider tip for working in the games industry today that you wish you had known when you were younger?
You know, it's like a drug. Be careful, you can spend all your life doing it. Just kidding! In fact, of course, this type of job will embody your dreams in reality if you dream about the same things I do. Just don't be afraid to believe in yourself!



Portfolio highlights

Some recent features that Pavel Dorokhovsky has worked on:

2006 *Sherlock Holmes - The Awakened*
2007 *Sherlock Holmes vs. Arsene Lupin*
2009 *CrimeCraft*
2012 *World of battles*
2013 *Metro Last Light*

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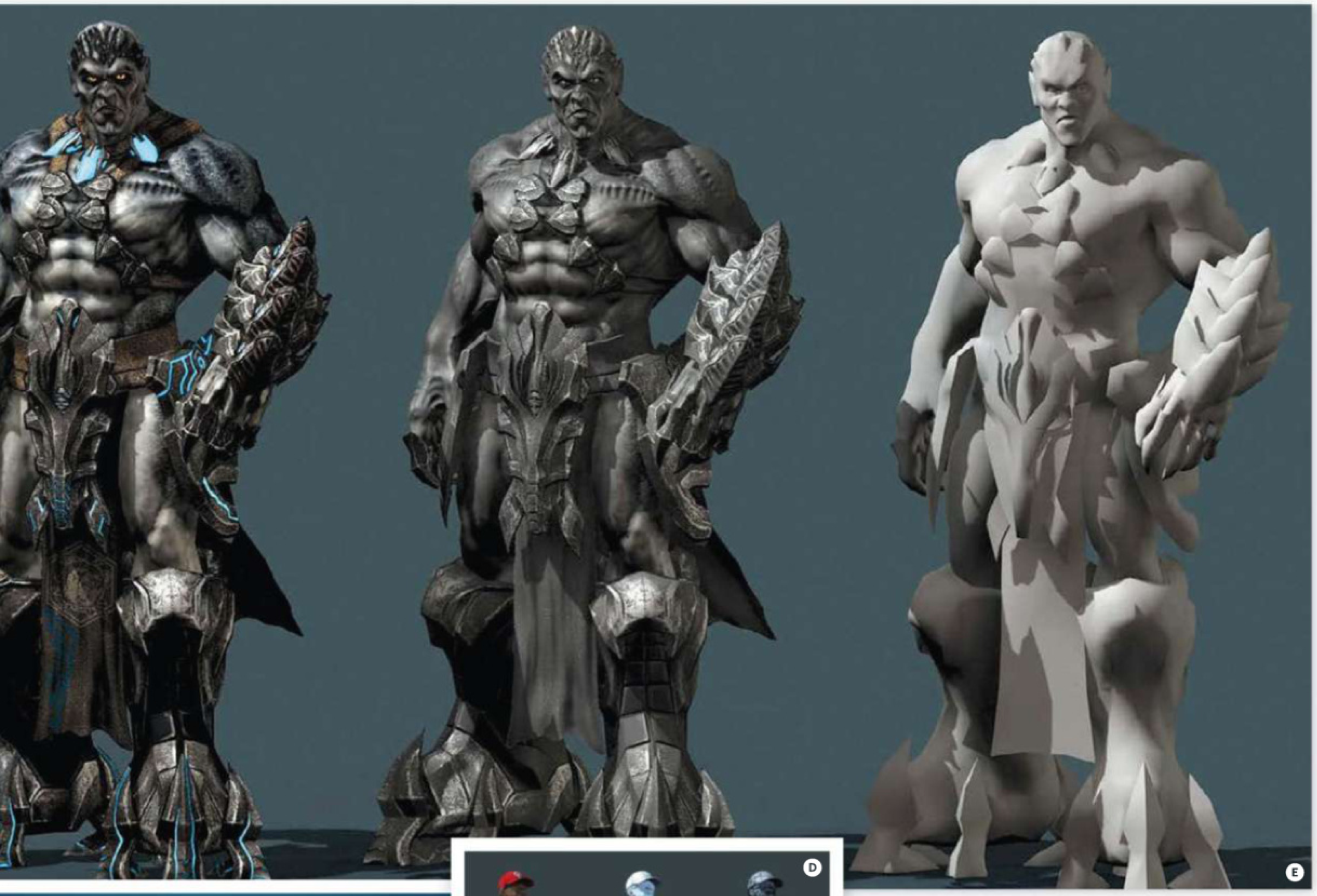

All images © Pavel Dorokhovsky

All about character

Dorokhovsky gives us an insight into how he was first inspired to create game characters and what his job at 4A Games entails

"I knew from the first day that I wanted to create only characters," says Dorokhovsky. "All this time I didn't even try to do anything else, because in my opinion you have to love what you're doing. My job involves creating characters and sometimes working with outsourcing as well as researching new technologies and promoting them in our projects."

> "This is not a profession you choose because of money or profit. People become 3D artists because it's their life's calling"

A "Creative people need freedom. Even the most brilliant artist can't create without freedom," says Dorokhovsky, advising artists that they should never ignore imagination

B Though he prefers to work in ZBrush most often, Dorokhovsky believes that "if you've got an infinite imagination, you can work in any program you wish"

C Though he doesn't begin creating his characters with a technique in mind, Dorokhovsky often finds himself "drawing new elements of a character with a finger in the air"

D Dorokhovsky tells us he doesn't believe in accepting a job solely for monetary gain, only when he feels interested by the company and the project involved

E The team at 4A Games is constantly active while creating their work, literally, as Dorokhovsky reveals: "We are not sitting still, we run around!"

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Website www.herts.ac.uk/courses/ma-games-art

The tutor

Neil Gallagher
The MA Games Art is led by Neil Gallagher, who has gained international recognition following 13 years of professional experience working for companies such as Microsoft, Nintendo and Sony across various consoles and titles as well as the TV and film industry. He was also praised at The Cannes Lions International Advertising Festival, winning the Cyber Category. Gallagher's research is currently focused on an exploration of the public understanding of physio-pharmacological phenomena through visualisation built on real-time games engine technologies.

The University of Hertfordshire's MA Games Art course was created to push students beyond just learning how to use CG tools: they fill the skills shortages critical for senior roles in a time of dramatic evolution in the industry.

Today games professionals are expected to not only know an extensive array of software, but also constantly adapt to an ever-changing industry toolset, something that the MA aims to reflect. The course enables students to focus on learning the commercial working practices, team leadership and time management needed to become a high-level specialist in their chosen field, or even progress to a research career; all the while using tools including xNormal, Maya, 3ds Max, ZBrush and Mudbox as well as the Unreal (UDK) and Crysis game engines.

Taught over a full year, or two years part-time, the MA Games Art is made up of intensive terms focused on solo research that enable the students to follow a very flexible work path. Every semester they need to produce three projects before choosing to further develop only the one they feel is most encouraging. This forms their Major Study project, which can take the form of a trailer, videogame, or a commercial product with a well-known studio.

The course boasts weekly guest speakers and frequent masterclasses, as well as placements with companies such as Activision, Bioware, Electronic Arts, Sony and Weta. Graduates have gone straight into working at triple-A games companies such as Frontier, Rocksteady and Eutechnyx Ltd, while several others have gone on to set up their own businesses. To find out more, visit the course website at www.herts.ac.uk/courses/ma-games-art or check out https://vimeo.com/uhmaaniga.

> "I could really see the difference before and after the MA Games Art course and would recommend it"
> **Girish Srinivasagopalan,** 2011 graduate

A Character design
» Girish Srinivasagopalan
Girish Srinivasagopalan, who graduated in 2011, now works as a 3D environmental artist creating assets from concept to the finished product at Frontier Creations

B Local industry
» Michael Parker
Many of the skills learned are practised in the studios of the local London videogames industry, with King's Cross station only a short 18 minutes away

C Digital sculpting
» Victor Gaza
"My practise lecturer gave me freedom to discover myself but also helped me with suggestions, resources and kept me on the right track," explains Gaza

D Student successes
» Huang Xiaochun
Xiaochun Huang graduated from the MA Games Art at University Hertfordshire in 2010 and went on to work at British videogames developer Eutechnyx

E Extra classes
» Therapatr Kijjawijitr
Postgraduate students are able to attend undergraduate sessions to update additional skills in subjects such as Film Making, VFX, 2D & 3D Animation and Photography

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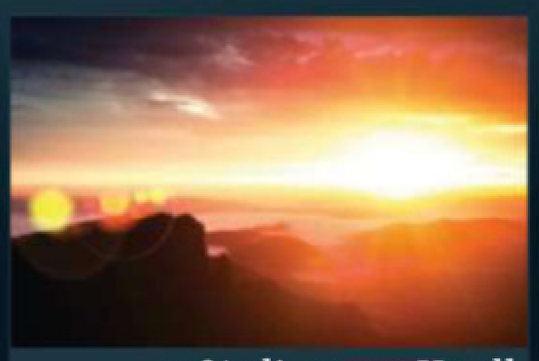

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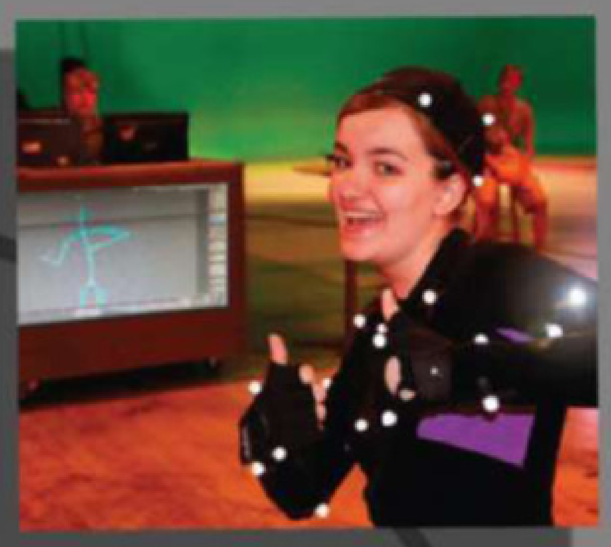

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